LINGI2252 – PROF. KIM MENS

SOFTWARE MAINTENANCE & EVOLUTION

LINGI2252 – PROF. KIM MENS

BAD CODE SMELLS

LINGI2252 – PROF. KIM MENS

A. INTRODUCTION

Bad Smells in Code

Reference

Martin Fowler, *Refactoring: Improving the Design of Existing Code*.
Addison Wesley, 2000. ISBN: 0201485672

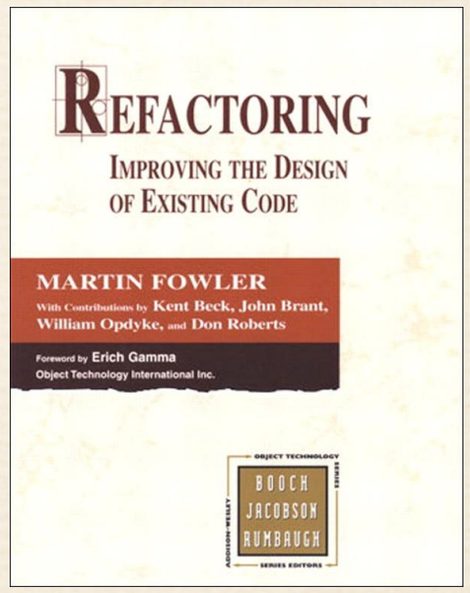
Chapter 3: *Bad Smells in Code*, by Kent Beck and Martin Fowler

Overview of this presentation

Introduction

A classification of bad smells, including a detailed illustration of some of them

Conclusion



Introduction

Bad Smells = “bad smelling code”

indicate that your code is ripe for refactoring

Bad smells are about

when to modify your code

Refactoring is about

how to change code by applying refactorings

Bad Smells

Allow us to identify

what needs to be changed in order to improve the code

A **recipe book** to help us choose the right refactoring pattern

No precise criteria

More to give an intuition and indications

Goal : a more "**habitable**" code.

Side note: *Habitable* code

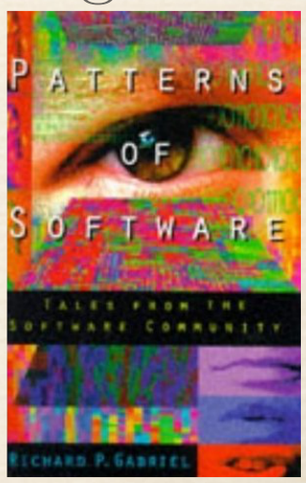
Habitable code is code in which developers feel at home
(even when the code was not written by them)

Symptoms of *inhabitable* code include
overuse of abstraction or inappropriate compression

Habitable code should be easy to read, easy to change

Software needs to be habitable because it always has to change

[Richard P. Gabriel, *Patterns of Software: Tales from the Software Community*, Oxford University Press, 1996]



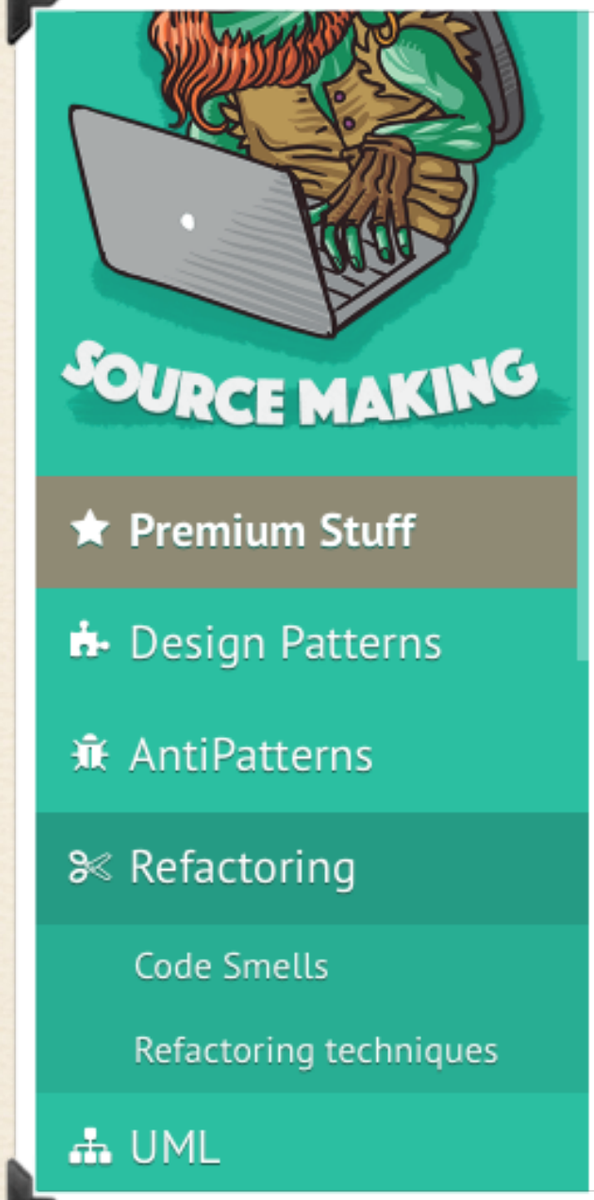
LINGI2252 – PROF. KIM MENS

B. CLASSIFICATION OF BAD SMELLS

INCLUDING A DETAILED DISCUSSION OF 5 OF THEM

An Online Classification

https://sourcemaking.com/refactoring



Refactoring

Bad code smells

Bloaters

Bloaters are code, methods and classes that have increased to such gargantuan proportions that they are hard to work with. Usually these smells do not crop up right away, rather they accumulate over time as the program evolves (and especially when nobody makes an effort to eradicate them).

- Long Method
- Large Class
- Primitive Obsession
- Long Parameter List
- Data Clumps

DISCLAIMER:
SEVERAL CARTOONS SHOWN IN THIS PRESENTATION WERE BORROWED FROM THAT SITE

Bad Smells : Classification

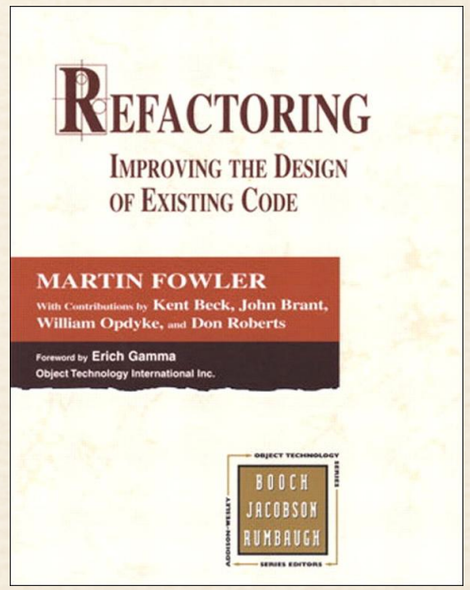
- **The top crime**
- Class / method organisation

  Large class, **Long Method**, Long Parameter List, Lazy Class, Data Class, …
- Lack of loose coupling or cohesion

  Inappropriate Intimacy, **Feature Envy**, Data Clumps, …
- Too much or too little delegation

  Message Chains, **Middle Man**, …
- Non Object-Oriented control or data structures

  Switch Statements, Primitive Obsession, …
- Other : **Comments**

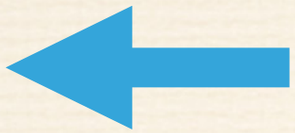


Bad Smells : Alternative Classification

- **Bloaters** are too large to handle
- **Object-orientation abusers** do not respect OO principles

- **Change preventers** stand in the way of change
- **Dispensables** are things you could do without
- **Couplers** contribute to excessive coupling between classes
- **Other smells**

Bad Smells : Classification

- **The top crime** 
- Class / method organisation

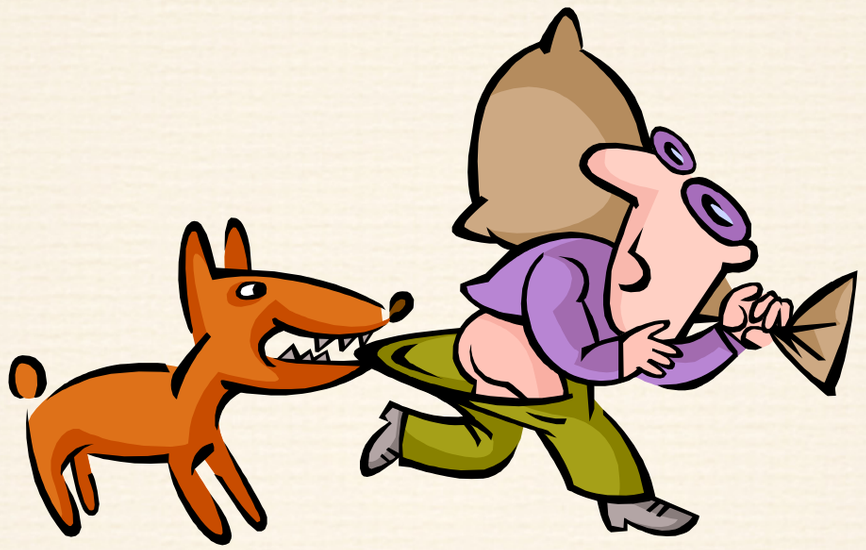
  Large class, **Long Method**, Long Parameter List, Lazy Class, Data Class, …
- Lack of loose coupling or cohesion

  Inappropriate Intimacy, **Feature Envy**, Data Clumps, …
- Too much or too little delegation

  Message Chains, **Middle Man**, …
- Non Object-Oriented control or data structures

  Switch Statements, Primitive Obsession, …
- Other : **Comments**

The top crime



Code duplication

Code duplication

Duplicated code is the number 1 in the stink parade !

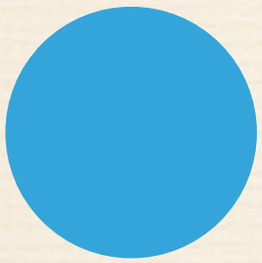
We have duplicated code when we have
the same code structure in more than one place

Why is duplicated code bad?

A fundamental *rule of thumb* :
it's always better to have a unified code

Code duplication example 1

```
public double ringSurface(r1,r2) {
      // calculate the surface of the first circle
      double surf1 = bigCircleSurface(r1);
      // calculate the surface of the second circle
      double surf2 = smallCircleSurface(r2);
      return surf1 - surf2;
}
```

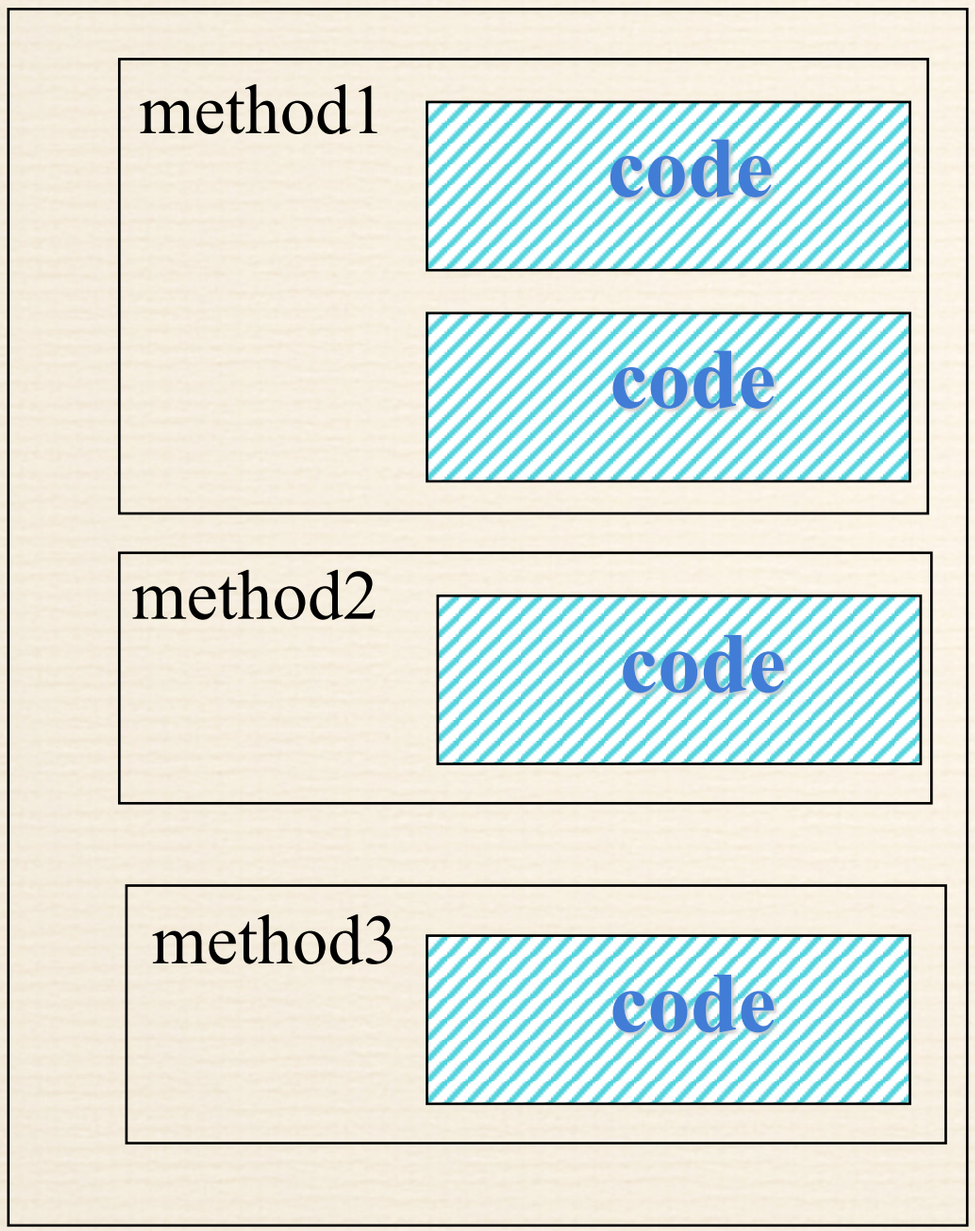


```
private double bigCircleSurface(r1) {
      pi = 4* ( arctan 1/2 + arctan 1/3 );
      return pi*sqr(r1);
}
```

```
private double smallCircleSurface(r2) {
      pi = 4* ( arctan 1/2 + arctan 1/3 );
      return pi*sqr(r2);
}
```

Code duplication example 2

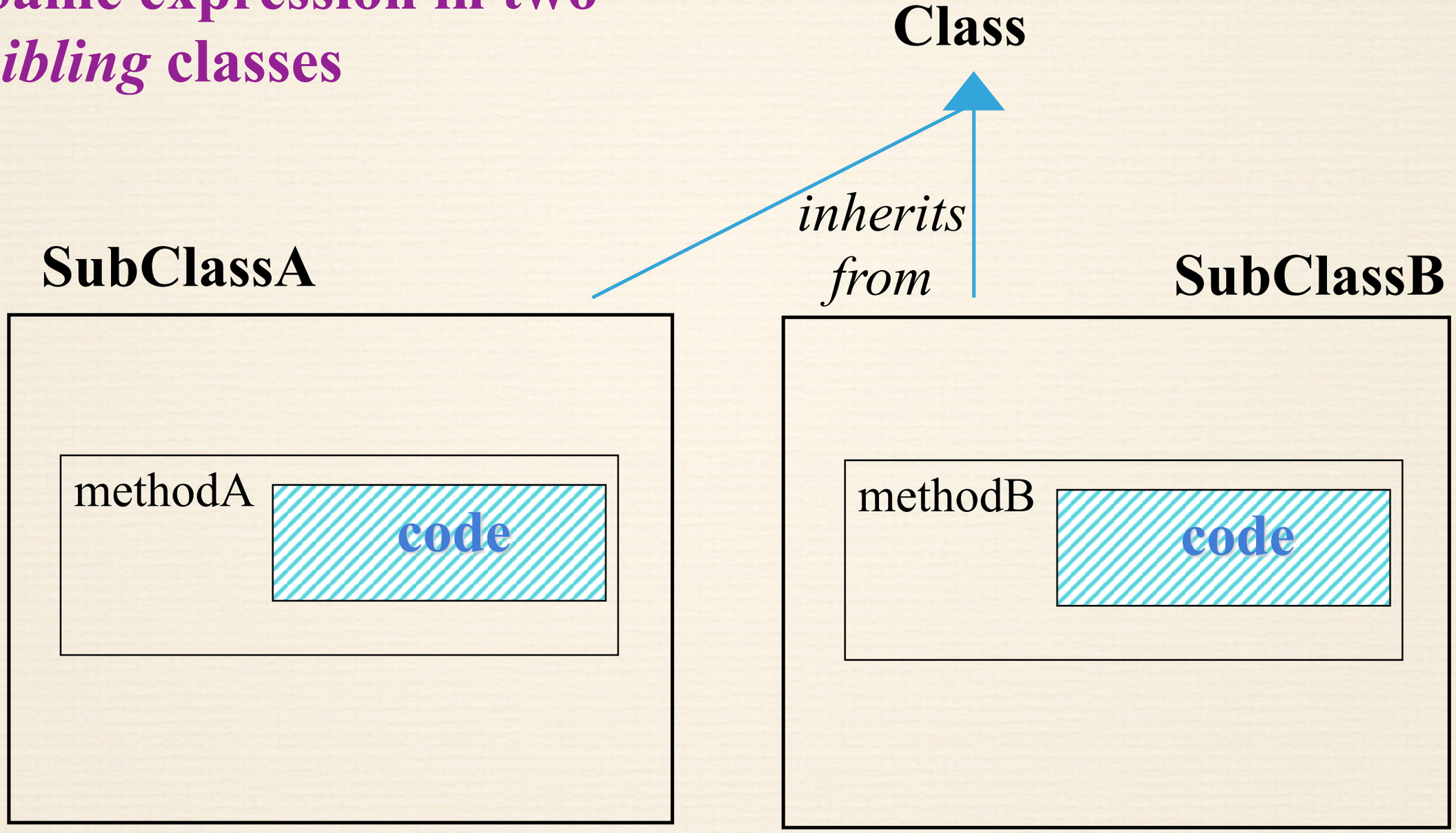
Class



Same expression in two or more methods of the *same* class

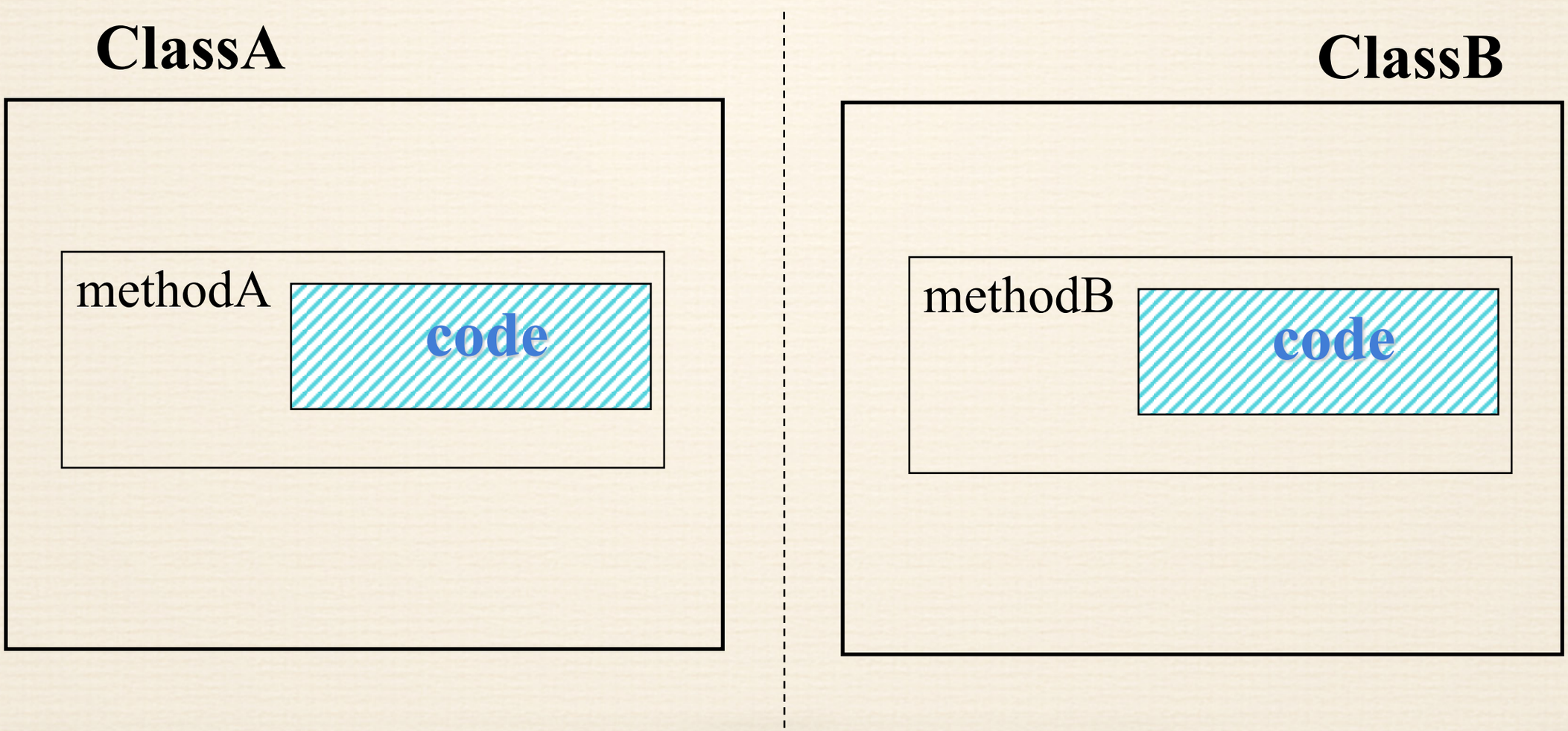
Code duplication example 3

Same expression in two *sibling* classes



Code duplication example 4

Same expression in two *unrelated* classes



Code duplication: Refactoring Patterns (1)

```
public double ringSurface(r1,r2) {
        // calculate the surface of the first circle
        double surf1 = surface(r1);
        //calculate the surface of the second circle
        double surf2 = surface(r2);
        return surf1-surf2;
}
```

Extract method

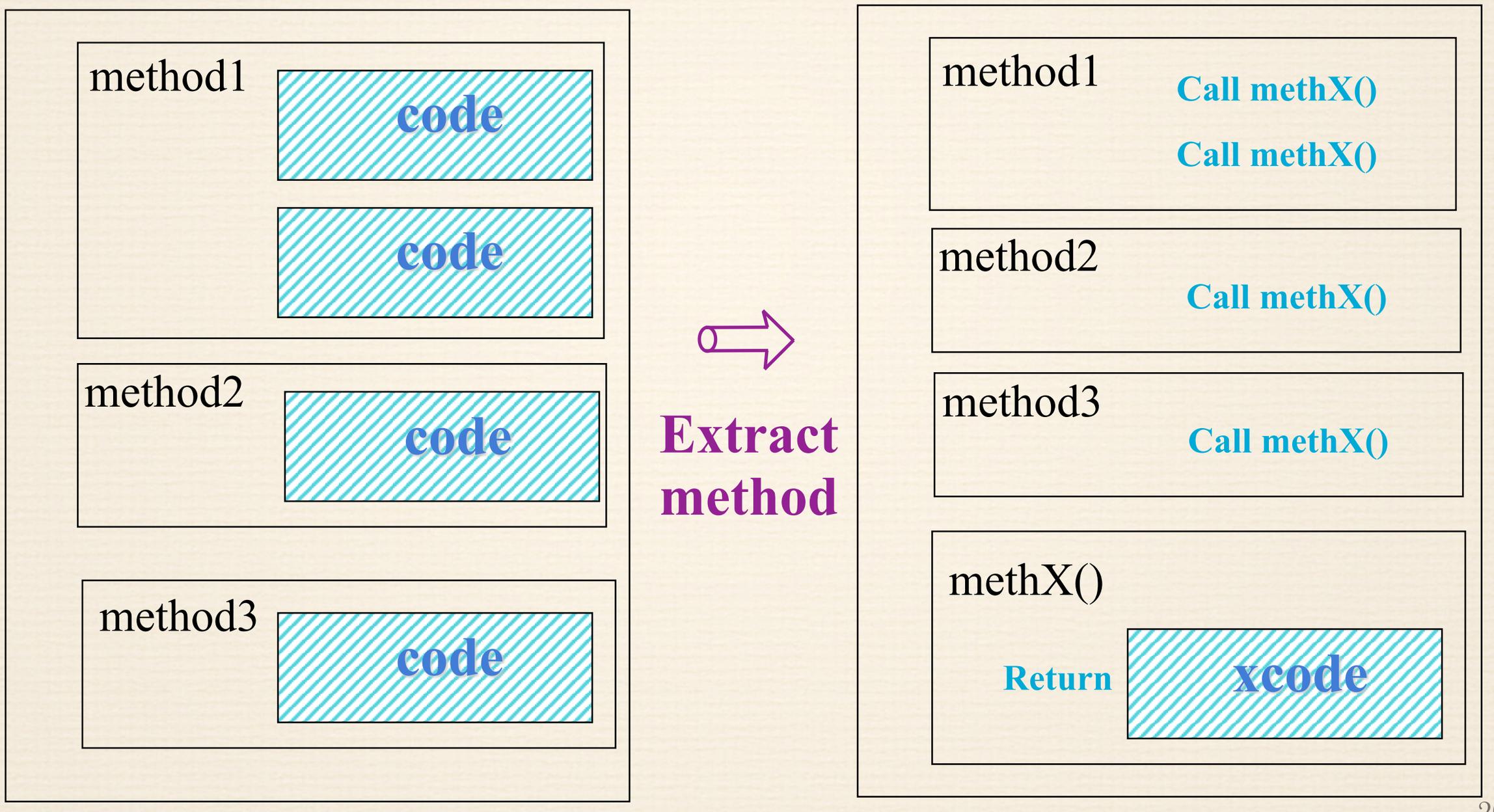
+

Rename method

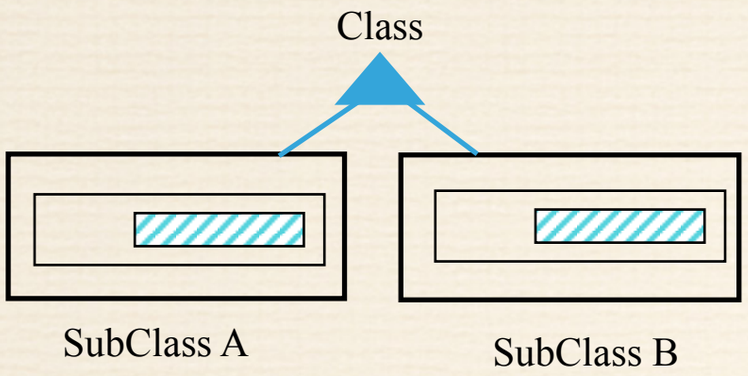
```
private double surface(r) {
        pi = 4* ( arctan 1/2 + arctan 1/3 );
        return pi*sqr(r);       }
```

Code duplication: Refactoring Patterns (2)

Same expression in two or more methods of the same class



Code duplication: Refactoring Patterns (3)



Same expression in two sibling classes

Same code

Similar code

Different algorithm

Extract method + Pull up field

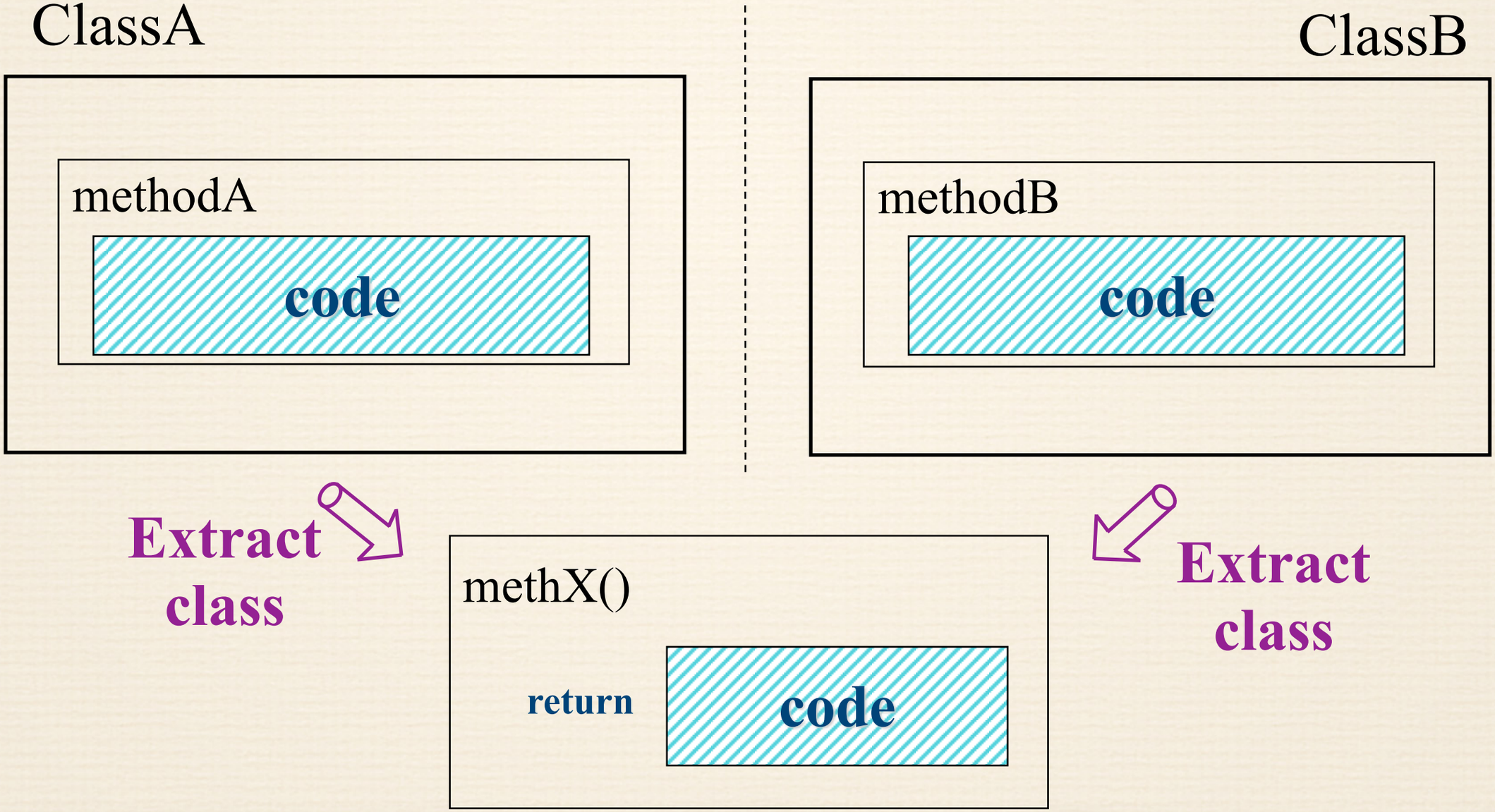
Extract method + Form Template Method

Substitute algorithm

Code duplication: Refactoring Patterns (4)

Same expression

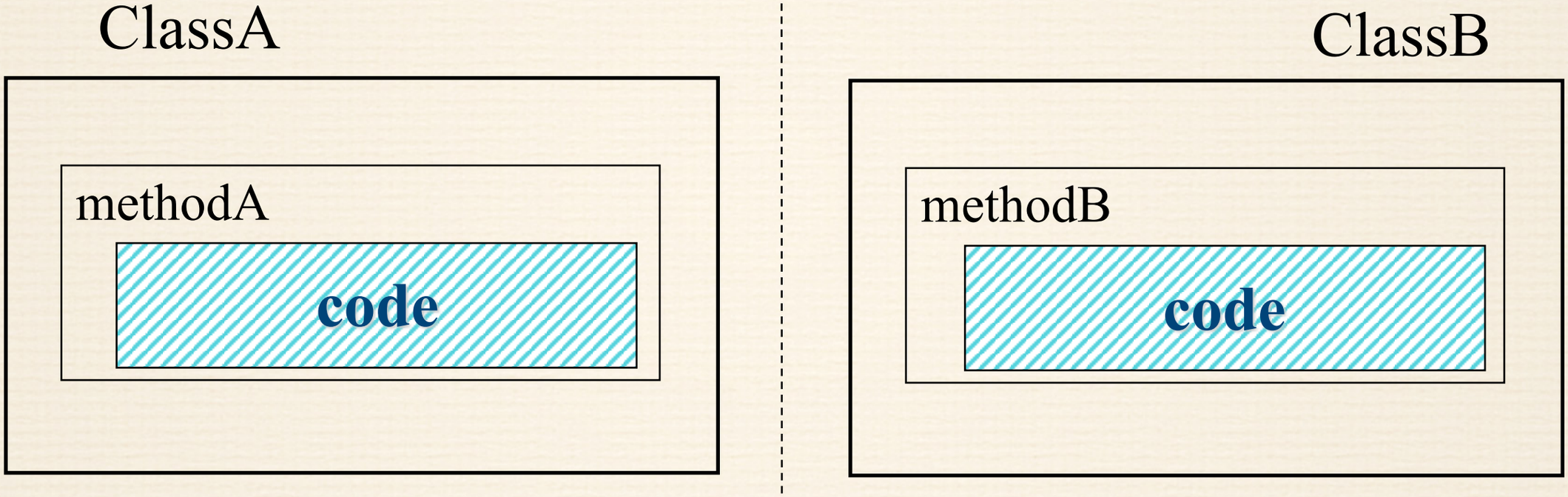
in two unrelated classes



Code duplication: Refactoring Patterns (4')

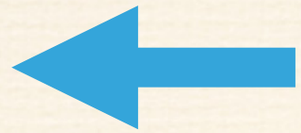
Same expression

in two unrelated classes



If the method really belongs in one of the two classes, keep it there and invoke it from the other class

Bad Smells : Classification

- **The top crime**
- Class / method organisation 

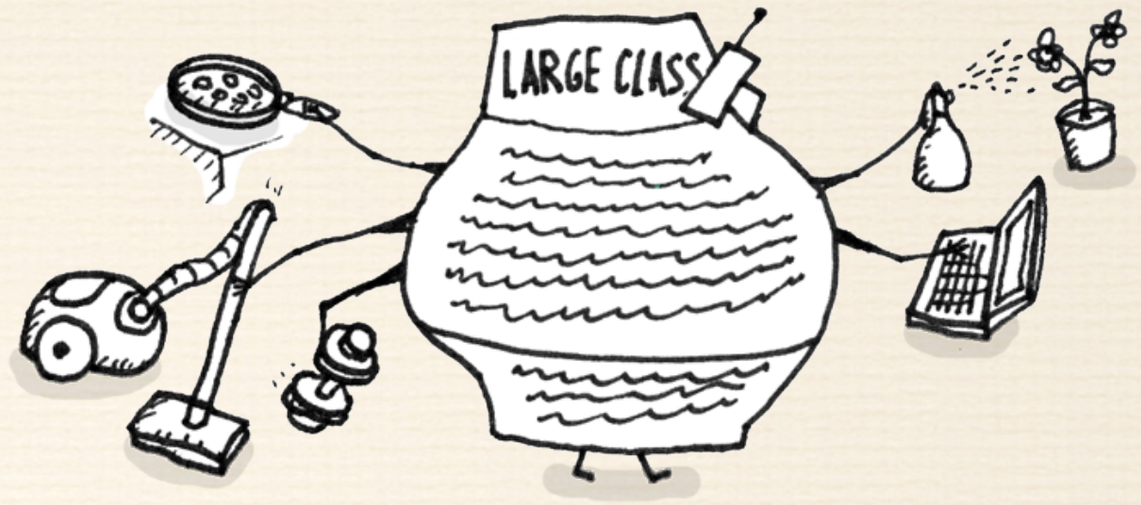
  Large class, **Long Method**, Long Parameter List, Lazy Class, Data Class, …
- Lack of loose coupling or cohesion

  Inappropriate Intimacy, **Feature Envy**, Data Clumps, …
- Too much or too little delegation

  Message Chains, **Middle Man**, …
- Non Object-Oriented control or data structures

  Switch Statements, Primitive Obsession, …
- Other : **Comments**

Large Class



*

A *large class* is a class that is trying to do too much

Often shows up as too many instance variables

Use **Extract Class** or **Extract Subclass** to bundle variables

choose variables that belong together in the extracted class

common prefixes and suffixes may suggest which ones may go together, e.g. `depositAmount` and `depositCurrency`

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Large Class

A class may also be too large in the sense that it has too much code

likely some code inside the class is duplicated

solve it by extracting the duplicated code in separate methods using **Extract Method**

or move part of the code to a new class, using **Extract Class** or **Extract Subclass**

if need be, move existing or extracted methods to another class using **Move Method**

Long Parameter List

In procedural programming languages, we pass as parameters everything needed by a subroutine

Because the only alternative is global variables

With objects you don't pass everything the method needs

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Long Parameter List

Long parameter lists are hard to understand

Pass only the needed number of variables

Use **Replace Parameter with Method** when you can get the data in one parameter by making a request of an object you already know about

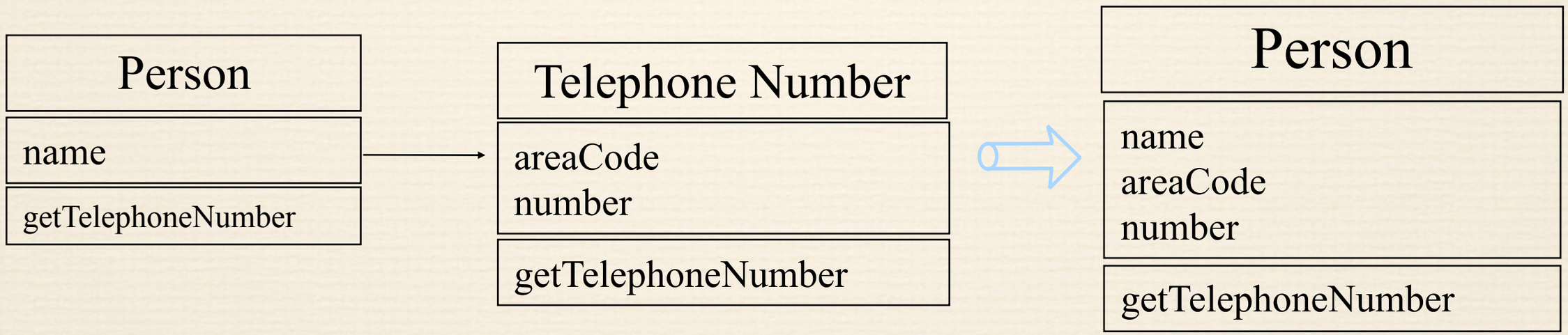
Lazy Class

Each class cost money (and brain cells) to maintain and understand

A class that isn't doing enough to pay for itself should be eliminated

It might be a class that was added because of changes that were planned but not made

Use **Collapse Hierarchy** or **Inline Class** to eliminate the class.



* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Data Class

*

Classes with just fields, getters, setters and nothing else

If there are public fields, use **Encapsulate Field**

For fields that should not be changed use **Remove Setting Method**

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Long Method

Object programs live best and longest with short methods

New OO programmers feel that OO programs are endless sequences of delegation

Older languages carried an overhead in subroutine calls which deterred people from small methods

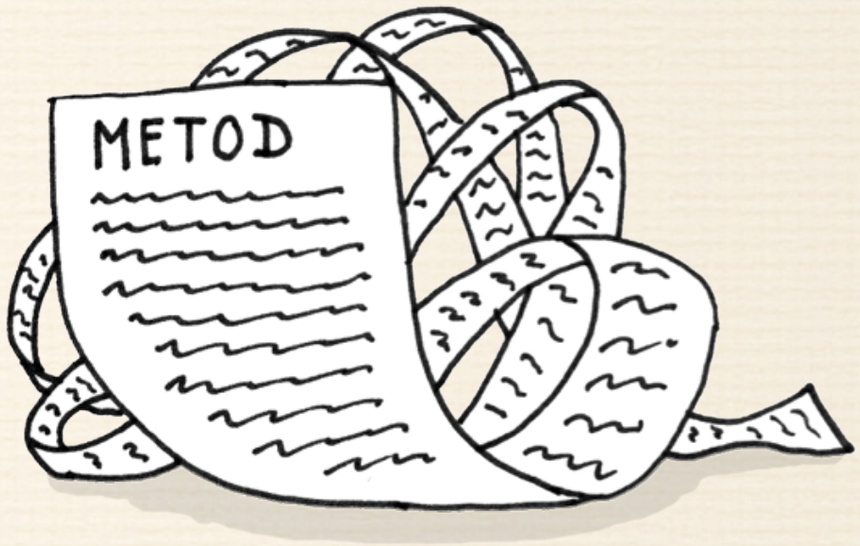
> There is still an overhead to the reader of the code because you have to switch context to see what the sub-procedure does (but the development environment helps us)

Important to have a good name for small methods

> **Rename Method**

Long Method

The longer a procedure is, the more difficult it is to understand what the code does



More difficult to read

Bad for maintainability

More difficult to make modifications

To summarise… less *habitable* !

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Long Method

Too avoid too long methods, decompose methods in many small ones

> Heuristic: whenever you feel the need to comment something, write a method instead
>
> > containing the code that was commented
> >
> > named it after the *intention* of the code
> > rather than how it does it

Even a single line is worth extracting if it needs explanation

Long Method: Example

```
void printOwing() {
        Enumeration e = _orders.elements();
        double outstanding = 0.0;
        // Print banner
        System.out.println(“******************“);
        System.out.println(“***** Customer *****“);
        System.out.println(“******************“);
        // Calcultate outstanding
        While (e.hasMoreElements()) {
                Order each = (Order) e.nextElement();
                outstanding += each.getAmount();
        }
        // Print details
        System.out.println(“name: “ + _name);
        System.out.println(“amount” + outstanding);
}
```

Example was shortened to fit on 1 slide

Long Method: Refactoring patterns

99% of the time, all we have to do to shorten a method is **Extract Method**

> Find parts of the method that seem to go together nicely and extract them into a new method.

It can lead to problems…

> Many temps : use **Replace Temp with Query**
>
> Long lists of parameters can be slimmed down with **Introduce Parameter Object**

Long Method: Refactoring patterns

But how to identify the clumps of code to extract ?

Look for comments…

> A block of code with a comment that tells you what it is doing can be replaced by a method whose name is based on the comments

Loops also give signs for extractions…

> Extract the loop and the code within the loop into its own method.

Long Method Example revisited

```
void printOwing() {
        Enumeration e = _orders.elements();
        double outstanding = 0.0;
        // Print banner
        System.out.println(“******************“);
        System.out.println(“***** Customer *****“);
        System.out.println(“******************“);
        // Calcultate outstanding
        While (e.hasMoreElements()) {
                Order each = (Order) e.nextElement();
                outstanding += each.getAmount();
        }
        // Print details
        System.out.println(“name: “ + _name);
        System.out.println(“amount” + outstanding);
}
```

Long Method Example revisited

```
void printOwing() {
        Enumeration e = _orders.elements();
        double outstanding = 0.0;
        // Print banner
        System.out.println("******************");
        System.out.println("***** Customer *****");
        System.out.println("******************");
        // Calcultate outstanding
        While (e.hasMoreElements()) {
                Order each = (Order) e.nextElement();
                outstanding += each.getAmount();
        }
        // Print details
        System.out.println("name: " + _name);
        System.out.println("amount" + outstanding);
}
```

Long Method Example revisited

```
void printOwing() {
        Enumeration e = _orders.elements();
        double outstanding = 0.0;

        printBanner();

        // Calcultate outstanding
        While (e.hasMoreElements()) {
                Order each = (Order) e.nextElement();
                outstanding += each.getAmount();
        }

        // Print details
        System.out.println(“name: “ + _name);
        System.out.println(“amount” + outstanding);
}

void printBanner() {
        System.out.println(“******************“);
        System.out.println(“***** Customer ****“);
        System.out.println(“******************“);
}
```

⇐ *1. Extract Method*
Trivially easy !

Long Method Example revisited

```
void printOwing() {
        Enumeration e = _orders.elements();
        double outstanding = 0.0;

        printBanner();

        // Calcultate outstanding
        While (e.hasMoreElements()) {
                Order each = (Order) e.nextElement();
                outstanding += each.getAmount();
        }
        // Print details
        System.out.println(“name: “ + _name);
        System.out.println(“amount” + outstanding);
}

void printBanner() {
        System.out.println(“******************“);
        System.out.println(“***** Customer ****“);
        System.out.println(“******************“);
}
```

Long Method Example revisited

```
void printOwing() {
        Enumeration e = _orders.elements();
        double outstanding = 0.0;

        printBanner();

        // Calcultate outstanding
        While (e.hasMoreElements()) {
                Order each = (Order) e.nextElement();
                outstanding += each.getAmount();
        }

        printDetails(outstanding);
}

void printDetails(double outstanding) {
        System.out.println(“name: “ + _name);
        System.out.println(“amount” + outstanding);
}

void printBanner() { … }
```

2.
Extract Method
Using Local Variables

Long Method Example revisited

```
void printOwing() {
        Enumeration e = _orders.elements();
        double outstanding = 0.0;

        printBanner();

        // Calcultate outstanding
        while (e.hasMoreElements()) {
                Order each = (Order) e.nextElement();
                outstanding += each.getAmount();
        }

        printDetails(outstanding);
}

void printDetails(double outstanding) {
        System.out.println(“name: “ + _name);
        System.out.println(“amount” + outstanding);
}

void printBanner() { … }
```

Long Method Example revisited

```
void printOwing() {
        printBanner();
        double outstanding = getOutstanding();
        printDetails(outstanding);
}
```

```
double getOutstanding() {
        Enumeration e = _orders.elements();
        double result = 0.0;
        While (e.hasMoreElements()) {
                Order each = (Order) e.nextElement();
                result += each.getAmount();
        }
        return result;
}
```

```
void printDetails(double outstanding) {…}
void printBanner() { … }
```

3.
Extract Method

Reassigning a Local Variable

Bad Smells : Classification

- **The top crime**
- Class / method organisation

  Large class, **Long Method**, Long Parameter List, Lazy Class, Data Class, …
- Lack of loose coupling or cohesion

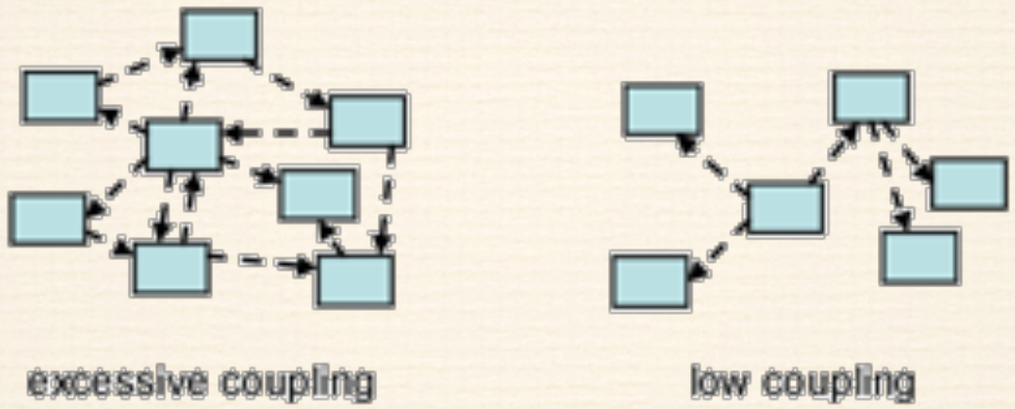
  Inappropriate Intimacy, **Feature Envy**, Data Clumps, …
- Too much or too little delegation

  Message Chains, **Middle Man**, …
- Non Object-Oriented control or data structures

  Switch Statements, Primitive Obsession, …
- Other : **Comments**

Coupling and cohesion

Coupling is the degree to which different software components depend on each other



Cohesion is the degree to which the elements within a software module belong together

Low cohesion and tight coupling are bad smells (why?)

Inappropriate Intimacy

Pairs of classes that know too much about each other's private details

Use **Move Method** and **Move Field** to separate the pieces to reduce the intimacy

*

If subclasses know more about their parents than their parents would like them to know

Apply **Replace Inheritance with Delegation**

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Data Clumps

A certain number of data items in lots of places

Examples: fields in a couple of classes, parameters in many method signatures

Ought to be made into their own object

When the clumps are fields, use **Extract Class** to turn them into an object

When the clumps are parameters, use **Introduce Parameter Object** to slim them down

Feature Envy

When a method seems more interested in a class other than the one it actually is in

*

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Feature Envy

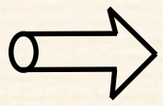
In other words, when a method invokes too many times methods on another object to calculate some value

Why is it bad to invoke a zillion times methods from another class?

> Because, in general, it is not logical from an OO point of view.
>
> *Put things together that change together !*

Feature Envy: Example (1)

```
public void mainFeatureEnvy () {
    OtherClass.getMethod1();
    OtherClass.getMethod2();
    OtherClass.getMethod3();
    OtherClass.getMethod4();
}
```



OtherClass

```
public void getMethod1 () { … }
public void getMethod2 () { … }
public void getMethod3 () { … }
public void getMethod4 () { … }
```

Feature Envy: Refactoring Patterns (1)

First solution : **Move Method**

OtherClass

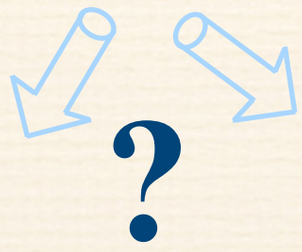
```
public void getMethod1 () { … }
public void getMethod2 () { … }
public void getMethod3 () { … }
public void getMethod4 () { … }
public void mainFeatureEnvy () {
   getMethod1();
   getMethod2();
   getMethod3();
   getMethod4();
}
```

Could we use
Extract method ?

Yes ! If only a part of the method suffers from envy

Feature Envy: Example (2)

```
Public Void mainFeatureEnvy () {
   Class1.getMethod1();
   Class1.getMethod2();
   Class2.getMethod3();
   Class2.getMethod4();
}
```



Class1

```
Public Void getMethod1 () { … }
Public Void getMethod2 () { … }
```

Class2

```
Public Void getMethod3 () { … }
Public Void getMethod4 () { … }
```

Feature Envy: Refactoring Patterns (2)

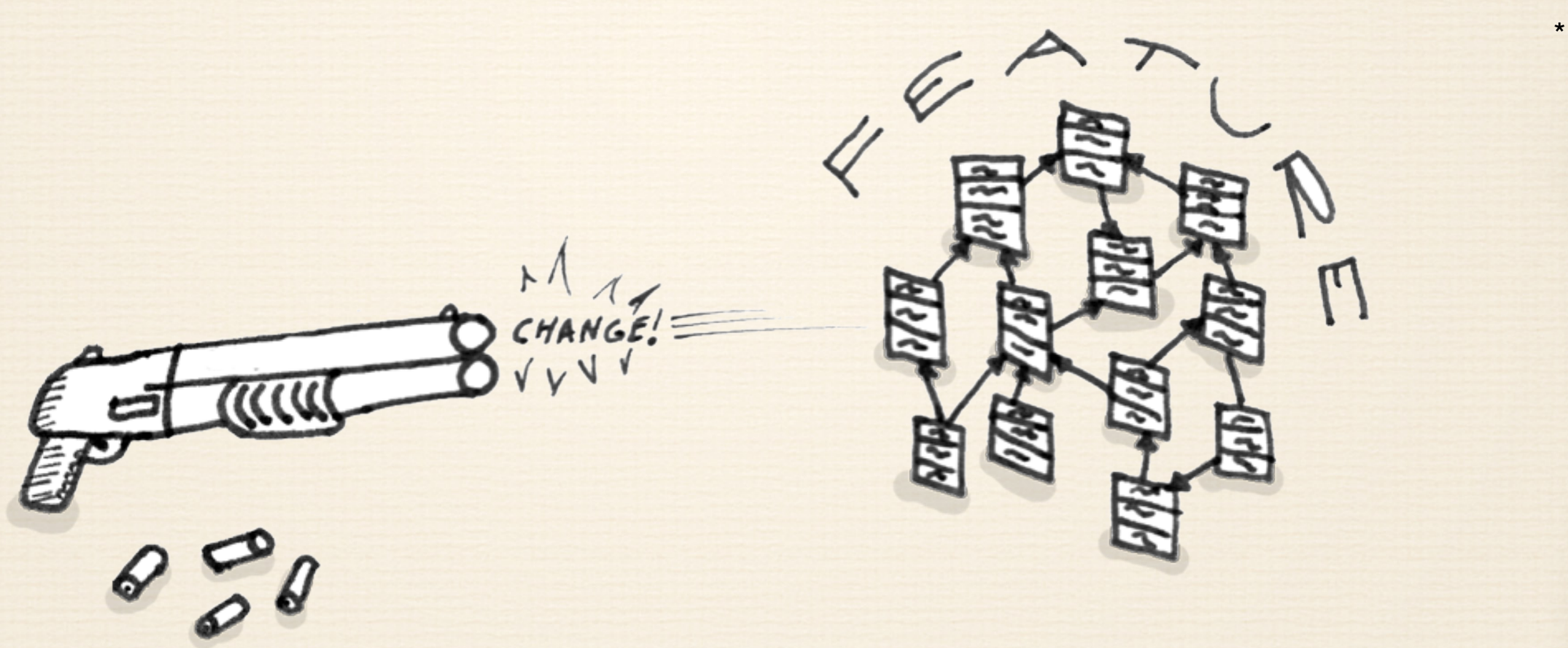
Use the same method as the first example :
Extract Method or **Move Method**

To choose the good class we use the following heuristic :

determine which class has most of the data and put the method with that data

Shotgun Surgery

When making one kind of change requires many small changes to a lot of different classes



* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Shotgun Surgery

Hard to find all changes needed; easy to miss an important change

Use **Move Method** and **Move Field** to put all change sites into one class

Put things together that change together !

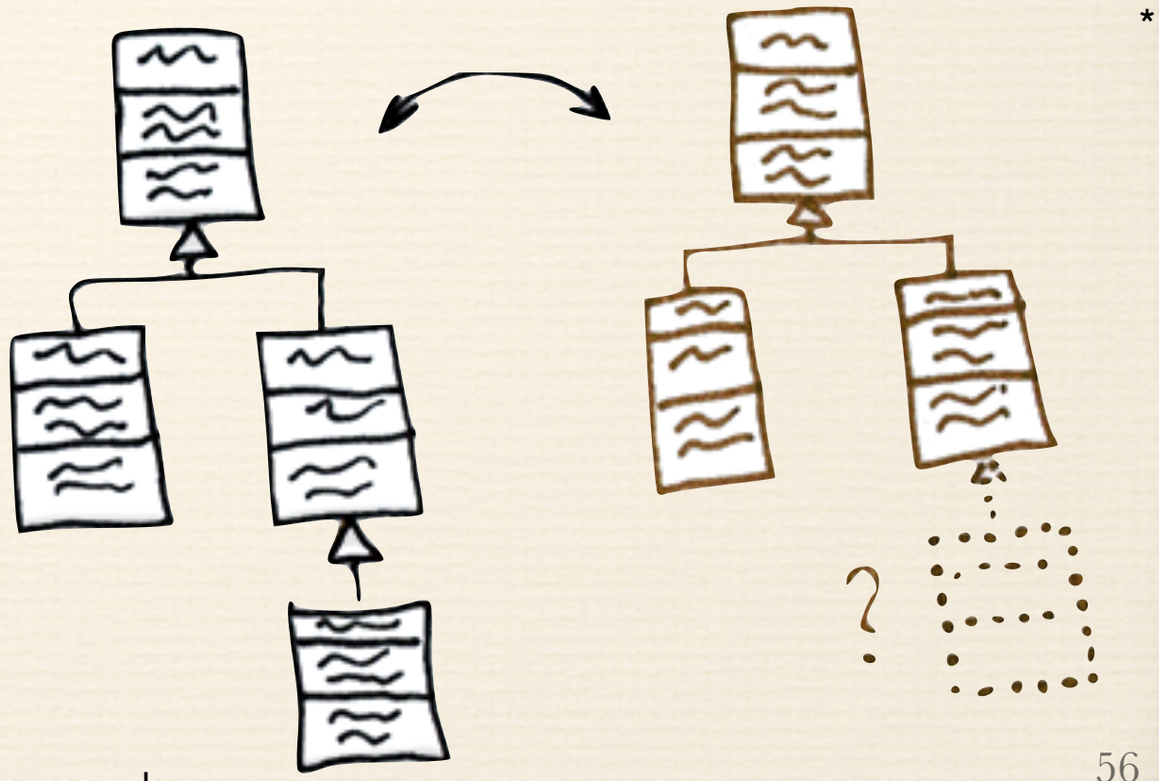
If a good place to put them does not exist, create one.

Parallel Inheritance Hierarchies

Special case of Shotgun Surgery

Each time I add a subclass to one hierarchy, I need to do it for all related hierarchies

Use **Move Method** and **Move Field**



*

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Bad Smells : Classification

- **The top crime**
- Class / method organisation

  Large class, **Long Method**, Long Parameter List, Lazy Class, Data Class, …
- Lack of loose coupling or cohesion

  Inappropriate Intimacy, **Feature Envy**, Data Clumps, …
- Too much or too little delegation

  Message Chains, **Middle Man**, …
- Non Object-Oriented control or data structures

  Switch Statements, Primitive Obsession, …
- Other : **Comments**

Message Chains

*

A client asks an object for another object who then asks that object for another object, etc.

Bad because client depends on the structure of the navigation

Use **Extract Method** and **Move Method** to break up or shorten such chains

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Middle Man

Objects hide internal details (encapsulation)

Encapsulation leads to delegation

It is a good concept but...

Sometimes it goes to far…

Middle Man

Real-life example:

You ask a director whether she is free for a meeting

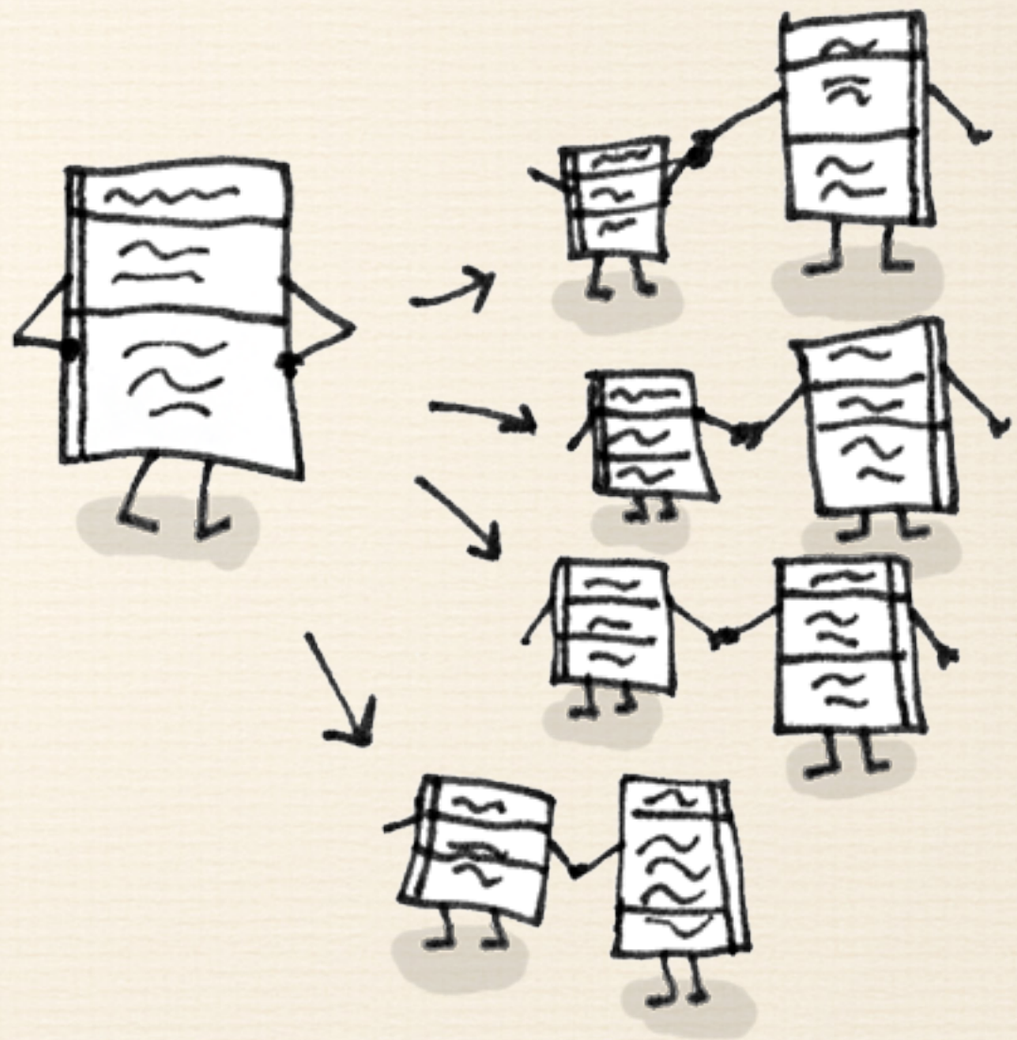
She delegates the message to her secretary that delegates it to the diary.

Everything is good… but, if the secretary has nothing else to do, it is better to remove her !

Middle Man

If a class performs only one action, delegating work to other classes, why does it exist at all?

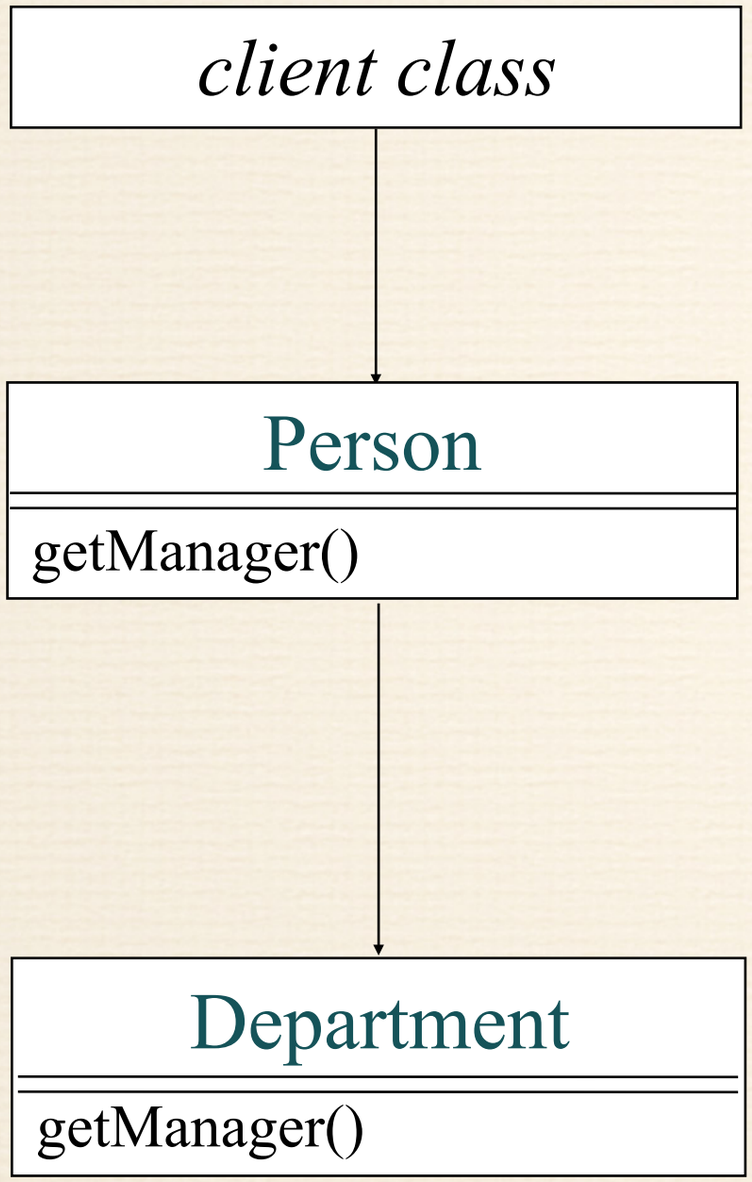
Sometimes most methods of class just delegate to another class



*

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Middle Man: Example



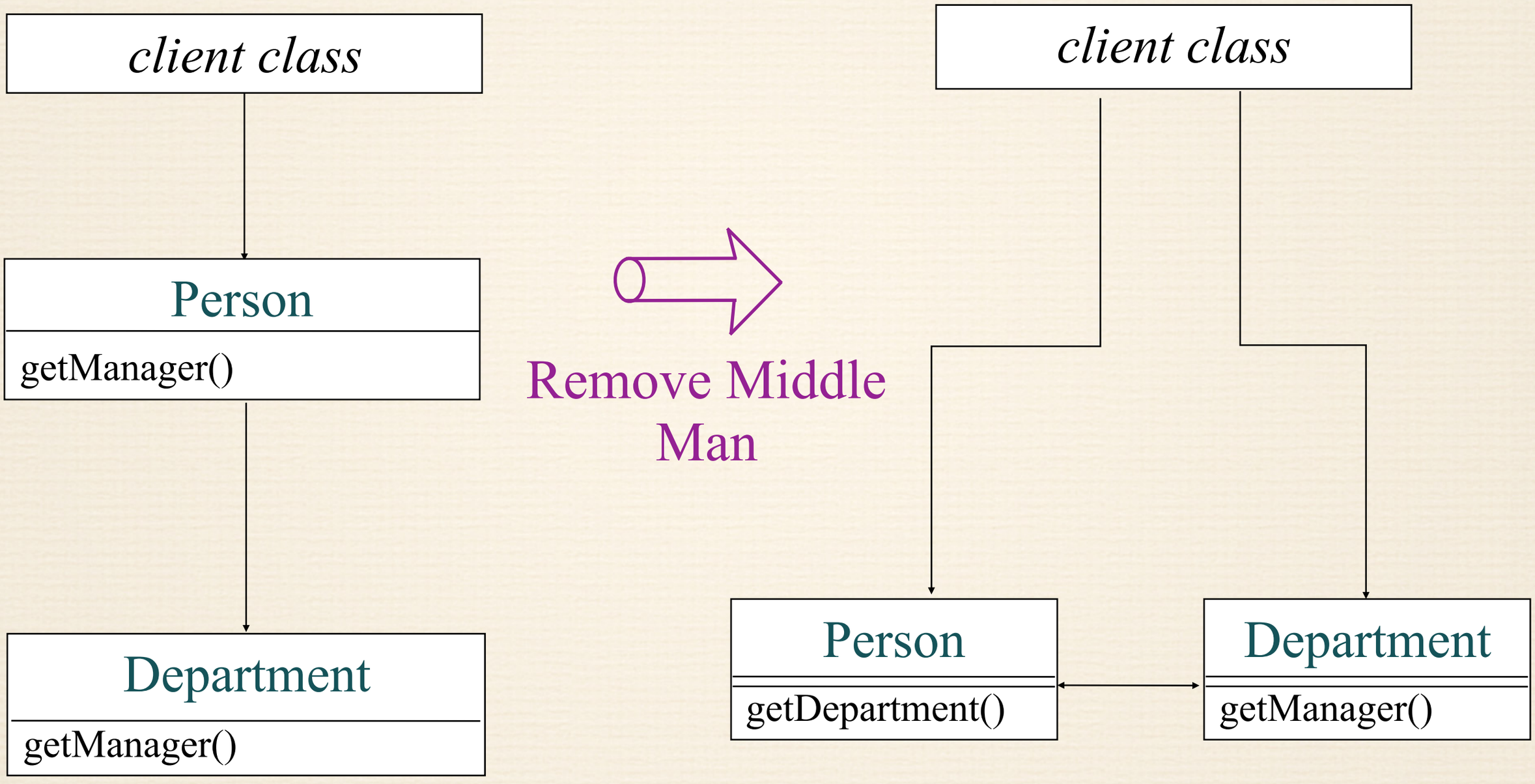

```
class  Person
        Department _department;
        public Person getManager() {
                return _department.getManager();
        }

class Department
        private Person _manager;
        public Department (Person manager) {
                _manager = manager;    }
        public Person getManager() {
                return _manager();        }
        }
```

The class Person is hiding the Department class.

To find a person's manager, clients ask :
Manager = john.getManager();

and the person then needs to ask :
_department.getManager();

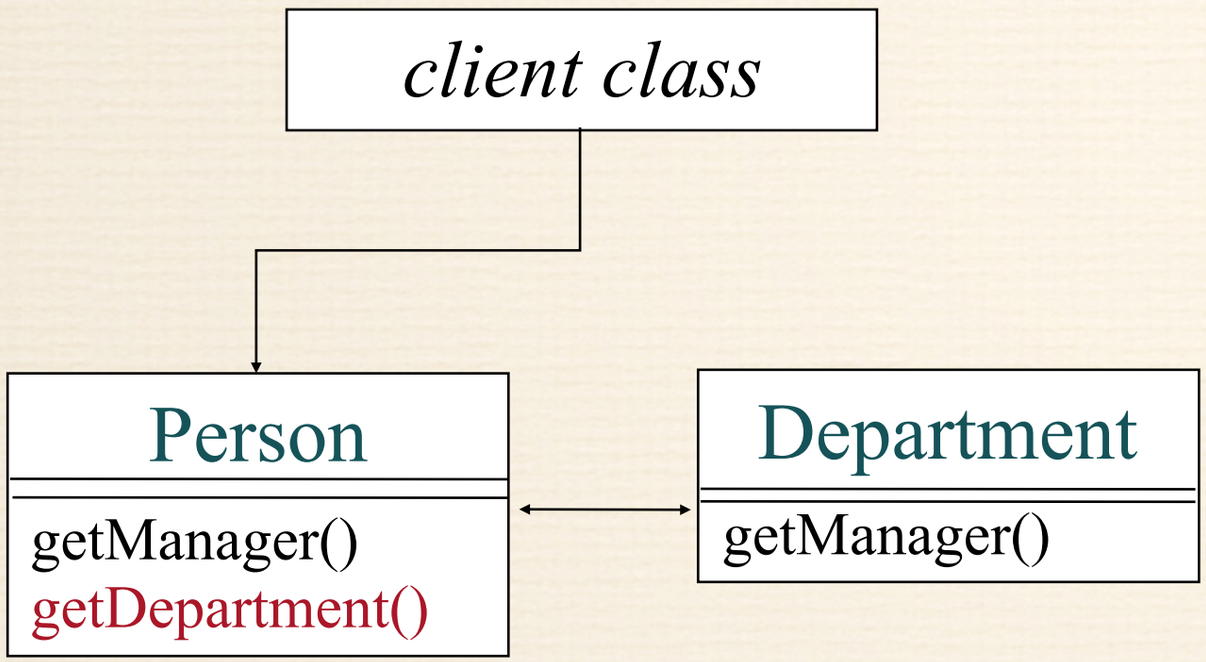
Middle Man: Refactoring



Middle Man: Refactoring

Remove Middle Man…

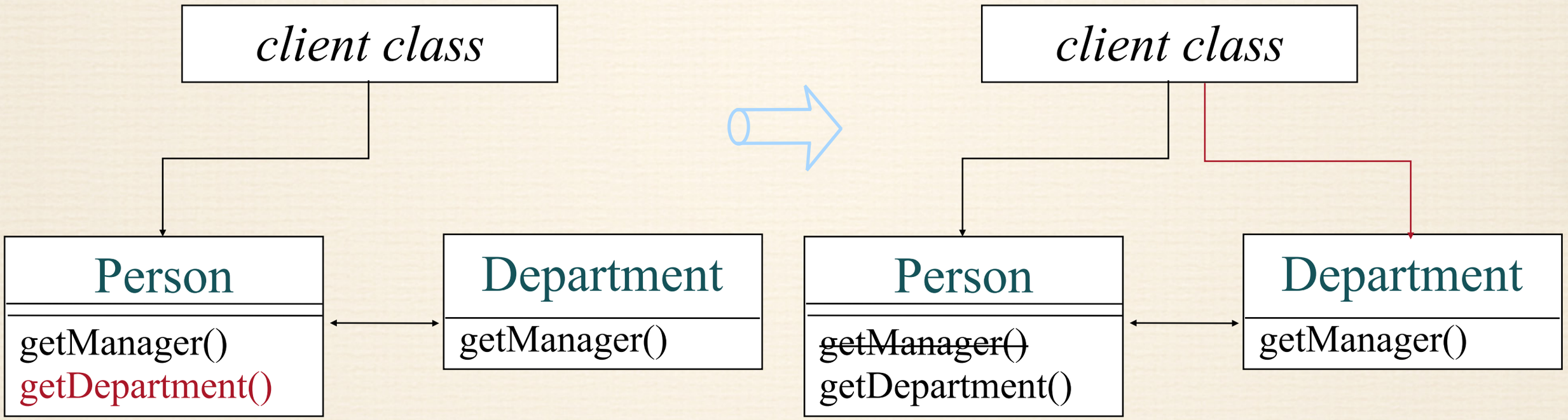
First step : Create an accessor for the delegate.




```
class  Person {
        Department _department;
        public Person getManager() {
                return _department.getManager(); }
        public Department getDepartment() {
                return _department; }
        }
```

Middle Man: Refactoring

Second step : For each client use of a delegated method, remove the method from the middle man and replace the call in the client to call a method directly on the delegate



Manager = john.getDepartment().getManager();

Last step : Compile and test.

Bad Smells : Classification

- **The top crime**
- Class / method organisation

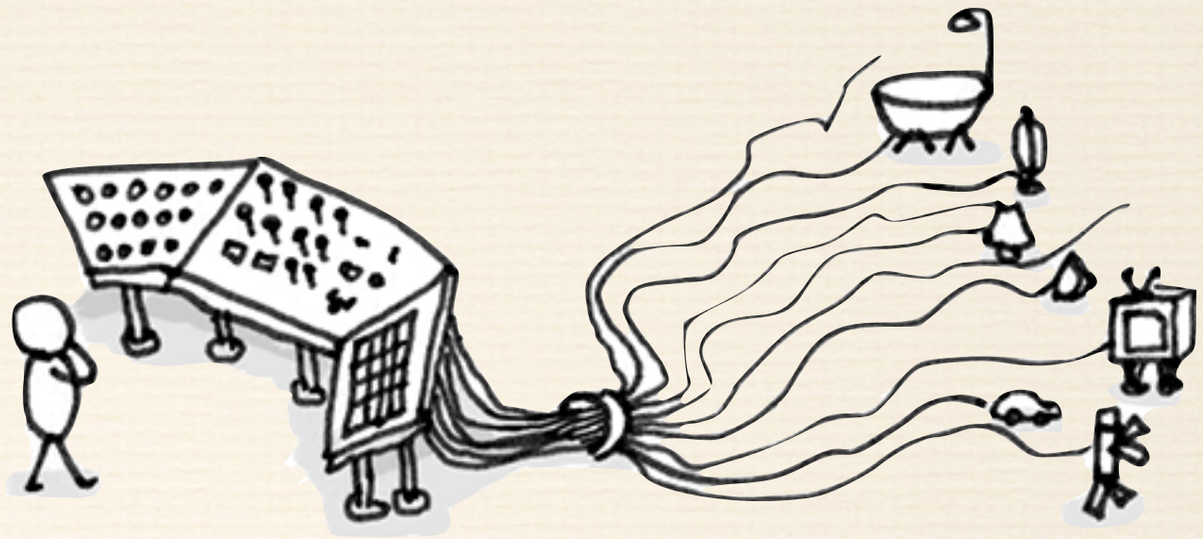
  Large class, **Long Method**, Long Parameter List, Lazy Class, Data Class, …
- Lack of loose coupling or cohesion

  Inappropriate Intimacy, **Feature Envy**, Data Clumps, …
- Too much or too little delegation

  Message Chains, **Middle Man**, …
- Non Object-Oriented control or data structures

  Switch Statements, Primitive Obsession, …
- Other : **Comments**

Switch Statements



*

Switch statements (“cases”)

often cause duplication

adding a new clause to the switch requires finding all such switch statements throughout your code

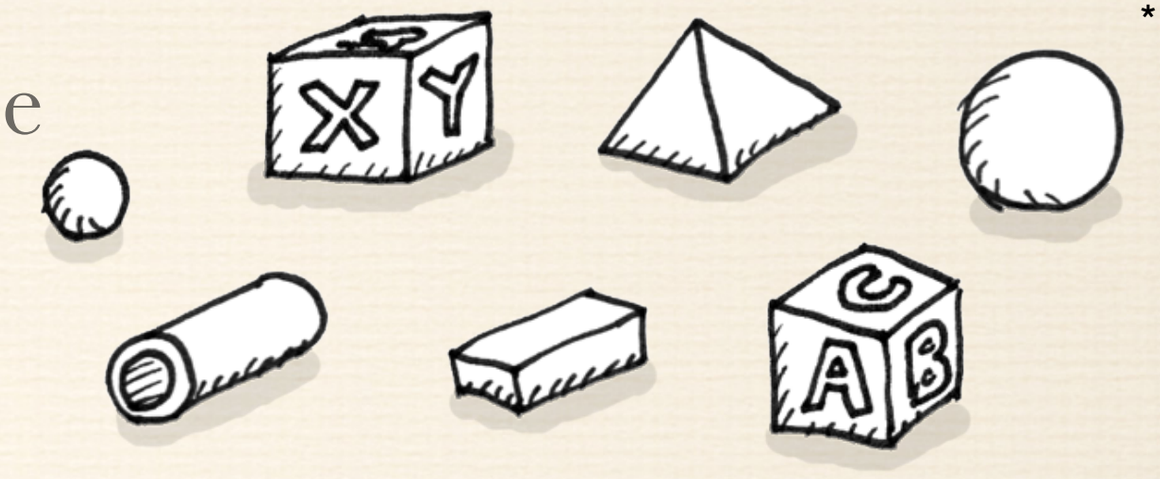
OO has a better ways to deal with actions depending on types: ***polymorphism*** !

Use **Extract Method** to extract the switch statement and then **Move Method** to get it into the class where polymorphism is needed.

Then use **Replace Conditional with Polymorphism** after you setup the inheritance structure.

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Primitive Obsession



Characterised by a reluctance to use classes instead of primitive data types

The difference between classes and primitive types is hard to define in OO

Use **Replace Data Value with Object** on individual data value.

Use **Extract Class** to put together a group of fields

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Bad Smells : Classification

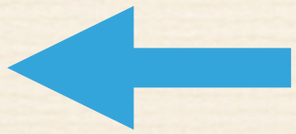
- **The top crime**
- Class / method organisation

  Large class, **Long Method**, Long Parameter List, Lazy Class, Data Class, …
- Lack of loose coupling or cohesion

  Inappropriate Intimacy, **Feature Envy**, Data Clumps, …
- Too much or too little delegation

  Message Chains, **Middle Man**, …
- Non Object-Oriented control or data structures

  Switch Statements, Primitive Obsession, …
- Other : **Comments**, …



Some more bad smells

Temporary Field

Divergent Change

Speculative Generality

Alternative Classes with Different Interfaces

Incomplete Library

Refused Bequest

Comments

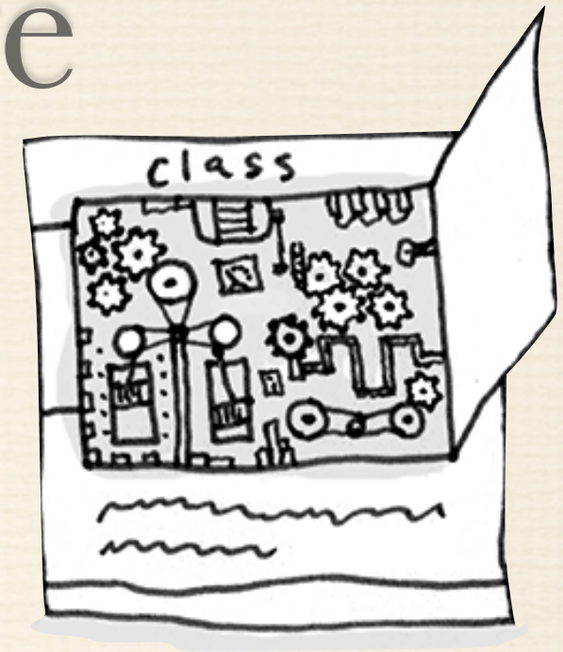
Temporary Field

Instance variables that are only set sometimes are hard to understand; you expect an object to need all its variables.

Use **Extract Class** to put the orphan variable and all the code that concerns it in one place.

Use **Introduce Null Object** when the variable is just around to deal with the null special case.

Divergent Change



*

When one class is commonly changed in different ways for different reasons.

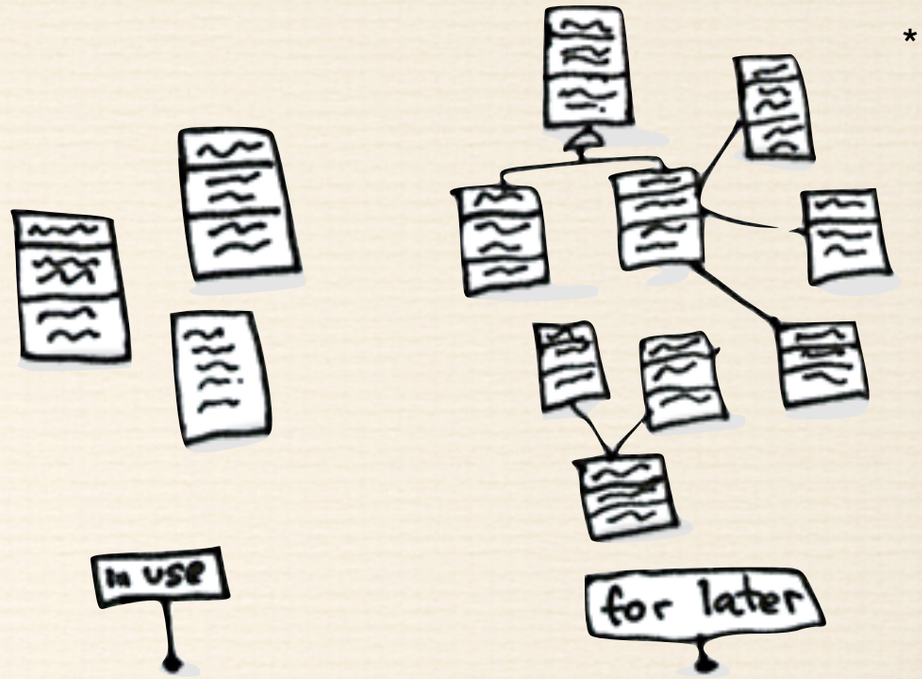
When we make a change we want to be able to jump to a single clear point in the system and make the change. If you can't do this you've got a bad smell.

To clean this up you identify everything that changes for a particular cause and use **Extract Class** to put them all together.

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Speculative Generality

When someone says “I think we may need the ability to do this someday ”



At this time you need all sorts of hooks and special cases to handle things that are not required

Use **Collapse Hierarchy** – **Inline Class** – **Remove Parameter** – **Rename Method**

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Alternative Classes with Different Interfaces

Methods in different classes that do the same thing but have different signatures.

Use **Rename Method**

Keep using **Move Method** to move behaviour until protocols are the same

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Incomplete Library Class

When a library or framework class doesn't provide all the functionality you need

But the solution to the problem, changing the library, is impossible since it is read-only.

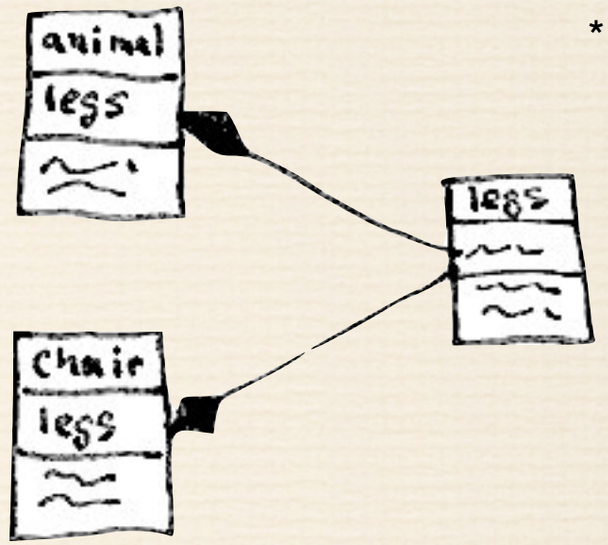
Use **Introduce Foreign Method** and **Introduce Local Extension**

> *See details of these refactorings for more information on how they solve the problem*

make a more concrete worked-out example of this one since it is related to question Q41

Refused Bequest

When a subclass ignores and doesn't need most of the functionality provided by its superclass



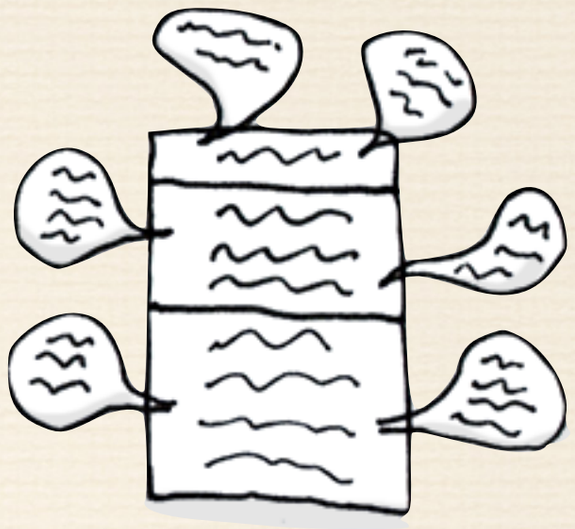
*

Can give confusion and problems

You need to create a new sibling class and use **Push Down Method** and **Push Down Field** to push all the unused methods to the sibling.

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Comments



Are comments bad?

Of course not! In general comments are a good thing to have.

But… sometimes comments are just an excuse for bad code

It stinks when you have a big comment which tries to explain bad code

such comments are used as a deodorant to hide the rotten code underneath

* Cartoon borrowed from https://sourcemaking.com/refactoring for didactic purposes only.

Comments: Example

« Look which rule to choose, and after we know which rule to take we initialize the array matrix with the correct value (depending on the rule). We do that until we have tested all rules and after that we … **blablabla »**

```
while (i<NRULES) {
        while (j<COL-1 && !(grammar[i][j+1].equals("N"))) {
          init(first);
          if (matrix[k][l] != 'R') {
                    if (cs.indexOf(q)!=-1) {
                     init(second);
                     for (int p=0;p < stIndex.size();indexHeadGram++){
                              …
```

Comments: Refactoring Patterns

Using refactorings, our first action is to remove the bad smells in the commented code

After having done this, we often find that the comments have become superfluous

To avoid bad smells we can often use **Extract Method**

Usually the name of the new method is enough then to explain what the code does

Comments: Example

```
public double price() {
        //price is base price – quantity discount  + shipping
        return quantity * itemPrice –
        Math.max(0, quantity – 500) * itemPrice * 0.05 +
        Math.min(quantity * itemPrice * 0.1, 100.0) }
```

⇩ **Extract method**

```
public double price() {return basePrice – quantityDiscount + shipping }

private double basePrice() {return quantity *itemPrice }

private double quantityDiscount () {return Math.max(0, quantity – 500) * itemPrice * 0.05 }

private double shipping () {Math.min(quantity * itemPrice * 0.1, 100.0) }
```

Comments: Refactoring Patterns

Sometimes the method is already extracted but still needs a comment to explain what it does

One solution could be : **Rename Method**

Comments: Example

```
public double price() {return basePrice – Price2 + shipping }

private double basePrice() {return quantity *itemPrice }

// Price2 represent the quantityDiscount
private double Price2 () {return Math.max(0, quantity – 500) * itemPrice * 0.05 }

private double shipping () {Math.min(quantity * itemPrice * 0.1, 100.0) }
```

Rename method

```
public double price() {return basePrice – quantityDiscount + shipping }

private double basePrice() {return quantity *itemPrice }

private double quantityDiscount () {return Math.max(0, quantity – 500) * itemPrice * 0.05 }

private double shipping () {Math.min(quantity * itemPrice * 0.1, 100.0) }
```

Comments: Refactoring Patterns

A section of code assumes something about the state of the program.

A comment is required to state the rule.

To avoid it, we can use **Introduce Assertion**

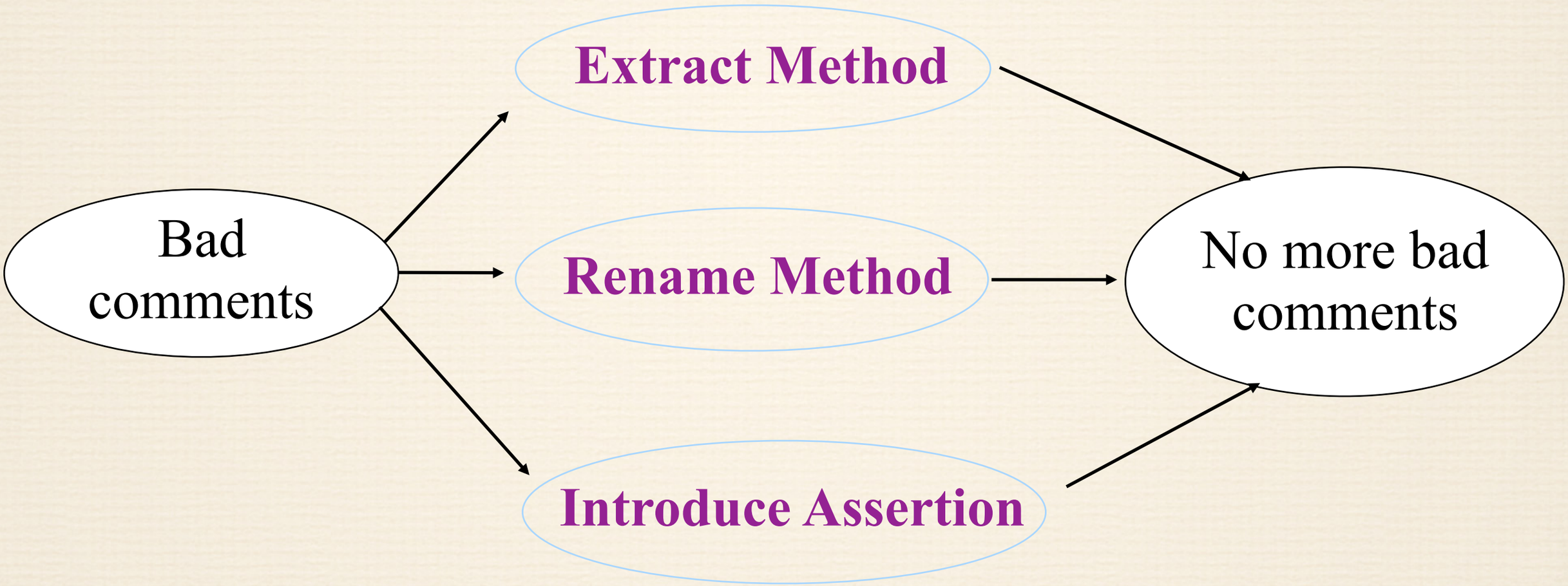
Comments: Example

```
Public double getExpenseLimit() {
        // should have either expense limit or a primary project
        return (_expenseLimit != NULL_EXPENSE) ?
         _expenseLimit:
         _primaryProject.getMemberExpenseLimit(); }
```

Introduce Assertion

```
Public double getExpenseLimit() {
    assert.isTrue (_expenseLimit != NULL_EXPENSE || _primaryProject != null);
    return (_expenseLimit != NULL_EXPENSE) ?
        _expenseLimit:
        _primaryProject.getMemberExpenseLimit(); }
```

Comments: Refactoring patterns (Summary)



Comments: some last remarks…

When is a comment needed / useful ?

> Tip : Whenever you feel the need to write a comment, first try to refactor the code so that any comment becomes superfluous

A good time to use a comment is when you *don't* know exactly what to do

A comment is a good place to say ***why*** you did something.

> This kind of information helps future modifiers, especially forgetful ones, including yourself

A last case is to use comments when something has not been done during development

LINGI2252 – PROF. KIM MENS

C. CONCLUSION

Problems with bad smells

Only a good recipe book and nothing more

It isn't always easy or even useful to use

Sometimes depends on context
and personal style / taste

Most of them are specific to OO

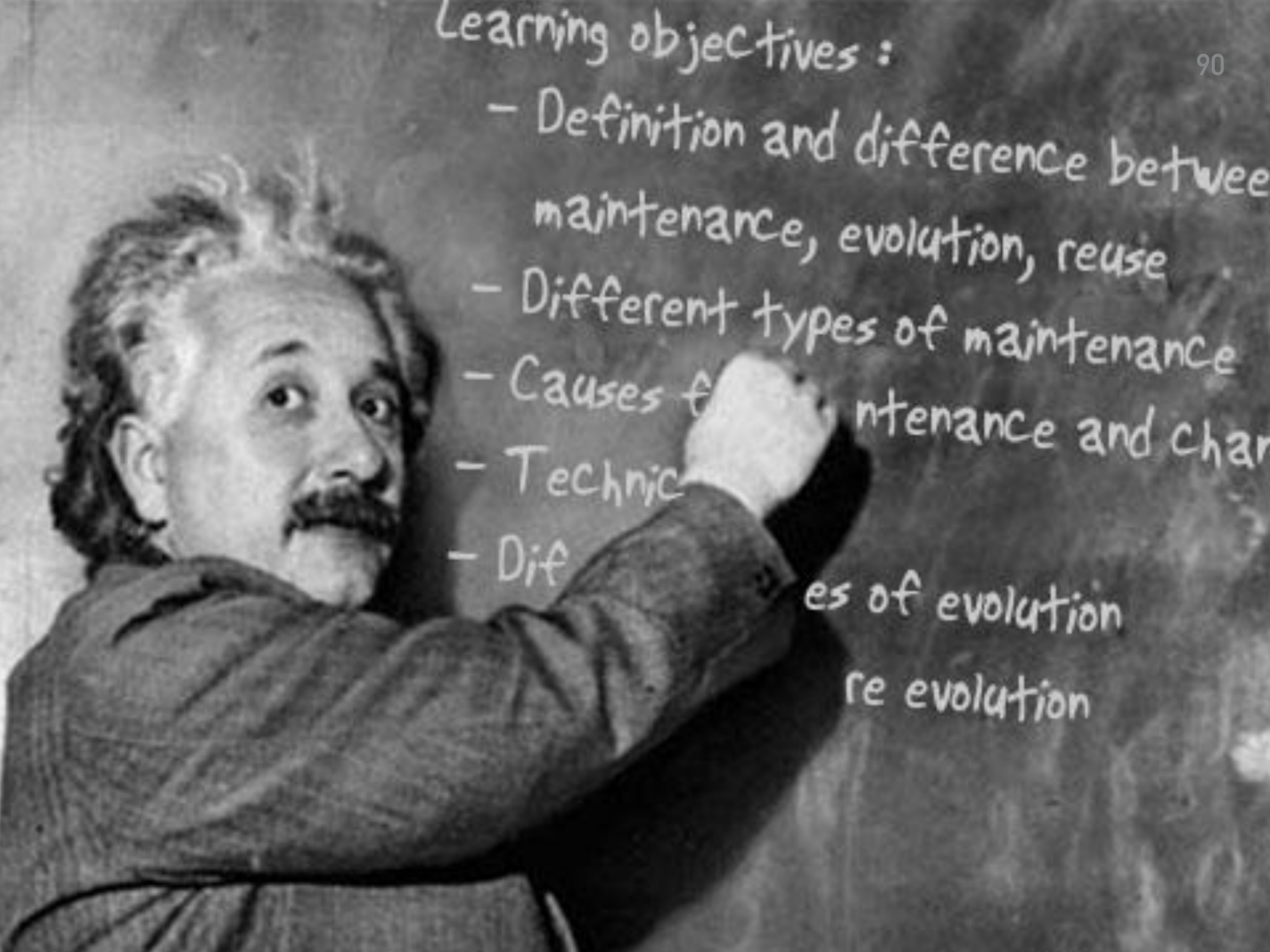
Conclusion

To have a good *habitable* code:

When? Bad Smells

How? Refactorings

Bad smells are **only** a recipe book to help us find the right refactoring patterns to apply


Learning objectives :
- Definition and difference betwee
maintenance, evolution, reuse
- Different types of maintenance
- Causes f ntenance and char
- Technic es of evolution
- Dif re evolution

POSSIBLE QUESTIONS (1)

- Which bad smells could be corrected by applying the "Introduce Parameter Object" refactoring? (Mention at least two different bad smells.)
- Which refactorings would you probably apply to address the "Large Class" bad smell?
- Explain and illustrate one of the following bad smells: Long Method, Feature Envy or Middle Man.
- Explain the Long Parameter List bad smell in detail. Why is it a bad smell? How could it be solved with a refactoring?
- What's the relation between the Long Parameter List bad smell and the Data Clumps bad smell?

POSSIBLE QUESTIONS (2)

- Explain and illustrate what the notion of "coupling" is. Should we strive for loose coupling or tight coupling? What bad smell describes a situation that violates this principle? Name and explain at least one.
- Explain and illustrate what the notion of "cohesion" is. Should we strive for low cohesion or high cohesion? What bad smell describes a situation that violates this principle? Name and explain at least one.
- Some bad smells are based on the principle that "things that change together should go together". Explain one of these bad smells, and the principle on which they are based, in detail.
- Name and explain at least one bad smell that explains a problem related to bad use of inheritance.
- When talking about "Comments" in the bad smells theory session, it was stated that comments are sometimes just there because the code is bad. Can you give an example of this and how such comments could become superfluous simply by refactoring the code?

CLASS... IS... DISMISSED.