Refactoring

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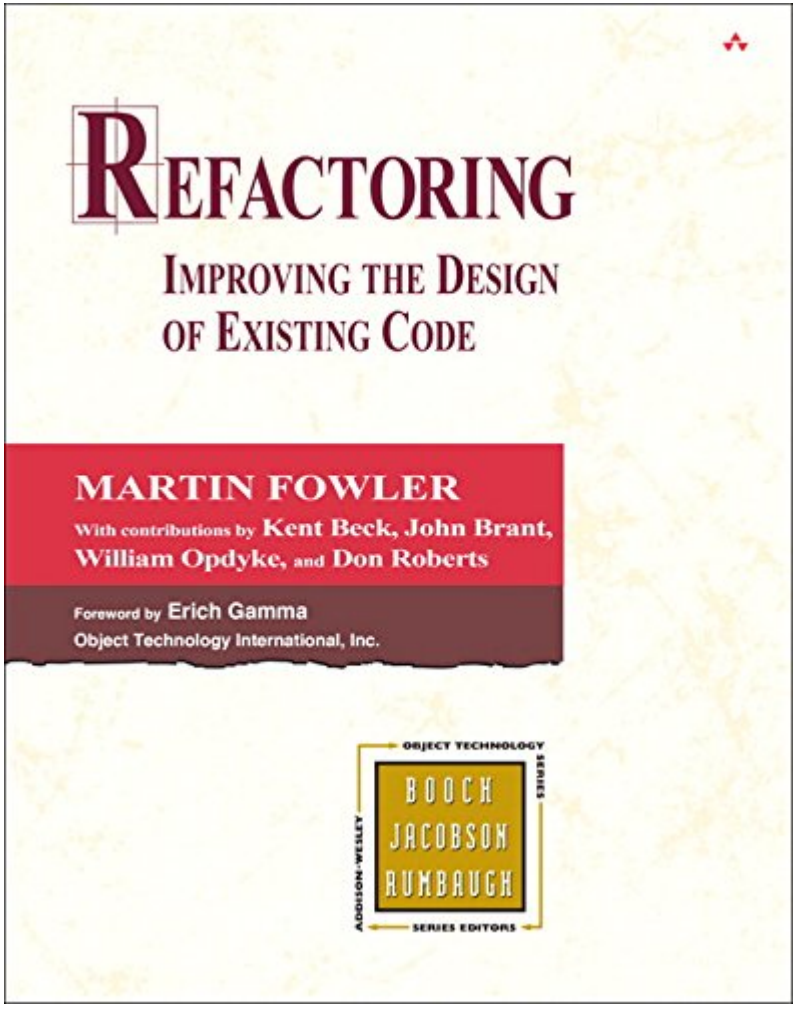
Reference

- Fowler, Martin. Refactoring: Improving the design of existing code. Addison-Wesley Professional, 1999.
- Kerievsky, Joshua. Refactoring to Patterns. Pearson Deutschland GmbH, 2005.
- Refactoring Guru

Introduction

Refactoring

- Refactoring is a **controlled** technique for **improving** the **design** of an **existing** code base.
- Its essence is applying a series of **small behavior-preserving transformations**, each of which "*too small to be worth doing*".
- However the **cumulative** effect of each of these transformations is quite **significant**.



Structure

- Motivation - Why?
- Mechanics - How?
- Example - Normally before and after code

Testing

Refactoring is intended to improve **nonfunctional** attributes of the software.

Having a good **testing suite** is of paramount importance **before** refactoring to ensure the code still behaves as expected.

Code Smells

Code Smells

- A code smell is a **surface indication** that usually corresponds to a **deeper problem** in the system.
- A code smell is something that's **quick to spot** (*sniffable*).
- A code smell **doesn't always** indicate a **problem**. Smells aren't inherently bad on their own, they are often an **indicator** of a **problem** rather than the problem themselves.

Code Smells - Bloaters

Long Method

A method contains too many lines of code.

Large Class

A class contains many fields/methods/lines of code.

Primitive Obsession

Use of primitives instead of small objects for simple tasks

Long Parameter List

More than three or four parameters for a method.

Data Clumps

Different parts of the code containing identical groups of variables.

Code Smells - OOP Abusers

Switch Statements

Complex switch/if operators.

Temporary Field

Temporary fields get their values only under certain circumstances.

Refused Bequest

If a subclass uses only some of the methods and properties inherited from its parents.

Alternative Classes with Different Interfaces

Two classes perform identical functions but have different method names.

Code Smells - Change Preventers

Divergent Change

Changing many unrelated methods when you make changes to a class.

Shotgun Surgery

Many small changes to many different classes.

Parallel Inheritance Hierarchies

Whenever you create a subclass for a class, you find yourself needing to create a subclass for another class.

Code Smells - Dispensables

Comments

A method is filled with explanatory comments.

Duplicate Code

Two code fragments look almost identical.

Lazy Class

Classes that don't do much.

Data Class

Class that contains only fields and crude methods for accessing them.

Dead Code

A variable, parameter, field, method or class that is no longer used.

Speculative Generality

There’s an unused class, method, field or parameter that was created to support anticipated future features

Code Smells - Couplers

Feature Envy

A method accesses the data of another object more than its own data.

Inappropriate Intimacy

One class uses the internal fields and methods of another class.

Message Chains

In code you see a series of calls resembling: `a->b()->c()->d()`.

Middle Man

If a class only delegates work to another class, why does it exist at all?

Refactorings

Just Some Examples

Extract Method

```
void printOwing() {
  printBanner();

  // Print details.
  System.out.println("name: " + name);
  System.out.println("amount: " + getOutstanding());
}
```

Extract Method

```
void printOwing() {
  printBanner();

  // Print details.
  System.out.println("name: " + name);
  System.out.println("amount: " + getOutstanding());
}
```

Refactored into:

```
void printOwing() {
  printBanner();
  printDetails(getOutstanding());
}

void printDetails(double outstanding) {
  System.out.println("name: " + name);
  System.out.println("amount: " + outstanding);
}
```

Can be used to eliminate: **Duplicate Code**, **Long Method**, **Feature Envy**, **Switch Statements**, **Message Chains**, **Comments** and **Data Class**.

Inline Method

```
class PizzaDelivery {
  // ...
  int getRating() {
    return moreThanFiveLateDeliveries() ? 2 : 1;
  }
  boolean moreThanFiveLateDeliveries() {
    return numberOfLateDeliveries > 5;
  }
}
```

Inline Method

```
class PizzaDelivery {
  // ...
  int getRating() {
    return moreThanFiveLateDeliveries() ? 2 : 1;
  }
  boolean moreThanFiveLateDeliveries() {
    return numberOfLateDeliveries > 5;
  }
}
```

Refactored into:

```
class PizzaDelivery {
  // ...
  int getRating() {
    return numberOfLateDeliveries > 5 ? 2 : 1;
  }
}
```

Can be used to eliminate: **Speculative Generality**.

Extract Variable

```
void renderBanner() {
  if ((platform.toUpperCase().indexOf("MAC") > -1) &&
       (browser.toUpperCase().indexOf("IE") > -1) &&
        wasInitialized() && resize > 0 )
  {
    // do something
  }
}
```

Extract Variable

```
void renderBanner() {
  if ((platform.toUpperCase().indexOf("MAC") > -1) &&
       (browser.toUpperCase().indexOf("IE") > -1) &&
        wasInitialized() && resize > 0 )
  {
    // do something
  }
}
```

Refactored into:

```
void renderBanner() {
  final boolean isMacOs = platform.toUpperCase().indexOf("MAC") > -1;
  final boolean isIE = browser.toUpperCase().indexOf("IE") > -1;
  final boolean wasResized = resize > 0;

  if (isMacOs && isIE && wasInitialized() && wasResized) {
    // do something
  }
}
```

Can be used to eliminate: **Comment**.

Split Temporary Variable

```
double temp = 2 * (height + width);
System.out.println(temp);
temp = height * width;
System.out.println(temp);
```

Split Temporary Variable

```
double temp = 2 * (height + width);
System.out.println(temp);
temp = height * width;
System.out.println(temp);
```

Refactored into:

```
final double perimeter = 2 * (height + width);
System.out.println(perimeter);
final double area = height * width;
System.out.println(area);
```

Moving Features between Objects

Move Method

Create a new method in the class that uses the method the most, then move code from the old method to there.

Move Field

Create a field in a new class and redirect all users of the old field to it.

Extract Class

Create a new class and place the fields and methods responsible for the relevant functionality in it.

Inline Class

Move all features from the class to another one.

Decompose Conditional

```
if (date.before(SUMMER_START) || date.after(SUMMER_END)) {
  charge = quantity * winterRate + winterServiceCharge;
}
else {
  charge = quantity * summerRate;
}
```

Decompose Conditional

```
if (date.before(SUMMER_START) || date.after(SUMMER_END)) {
  charge = quantity * winterRate + winterServiceCharge;
}
else {
  charge = quantity * summerRate;
}
```

Refactored into:

```
if (isSummer(date)) {
  charge = summerCharge(quantity);
}
else {
  charge = winterCharge(quantity);
}
```

Can be used to eliminate: **Long Method**.

Consolidate Duplicate Conditional Fragments

```
if (isSpecialDeal()) {
  total = price * 0.95;
  send();
}
else {
  total = price * 0.98;
  send();
}
```

Consolidate Duplicate Conditional Fragments

```
if (isSpecialDeal()) {
  total = price * 0.95;
  send();
}
else {
  total = price * 0.98;
  send();
}
```

Refactored into:

```
if (isSpecialDeal()) {
  total = price * 0.95;
}
else {
  total = price * 0.98;
}
send();
```

Can be used to eliminate: **Duplicate Code**.

Replace Nested Conditional with Guard Clauses

```
public double getPayAmount() {
  double result;
  if (isDead){
    result = deadAmount();
  }
  else {
    if (isSeparated){
      result = separatedAmount();
    }
    else {
      if (isRetired){
        result = retiredAmount();
      }
      else{
        result = normalPayAmount();
      }
    }
  }
  return result;
}
```

```
public double getPayAmount() {
  if (isDead){
    return deadAmount();
  }
  if (isSeparated){
    return separatedAmount();
  }
  if (isRetired){
    return retiredAmount();
  }
  return normalPayAmount();
}
```

Introduce Null Object

```
if (customer == null) {
  plan = BillingPlan.basic();
}
else {
  plan = customer.getPlan();
}
```

Introduce Null Object

```
if (customer == null) {
  plan = BillingPlan.basic();
}
else {
  plan = customer.getPlan();
}
```

Refactored into:

```
class NullCustomer extends Customer {
  boolean isNull() {
    return true;
  }
  Plan getPlan() {
    return new NullPlan();
  }
}

customer = (order.customer != null) ?
  order.customer : new NullCustomer();

plan = customer.getPlan();
```

Can be used to eliminate: **Switch Statements** and **Temporary Field.**

Simplifying Method Calls

Rename Method, **Add Parameter** and **Remove Parameter**

Separate Query from Modifier

Split a method into two separate methods. One of them should return the value and the other one modifies the object.

Parameterize Method

```
increaseOne();
increaseFive();
```

Introduce Parameter Object

Replace parameters with an object.

Replace Error Code with Exception

A method returns a special value that indicates an error? Throw an exception instead.

Dealing with Generalization

Pull Up Field, **Pull Up Method** and **Pull Up Constructor Body**

Pull up to the parent class.

Push Down Method and **Push Down Field**

Push down to a subclass.

Extract Subclass, **Extract Superclass** and **Extract Interface**

Transform one class into two classes.

Collapse Hierarchy

Transform many classes into one class.

Replace Inheritance with Delegation and **Replace Delegation with Inheritance**