Patterns in Software Engineering

Lecturer: Raman Ramsin

Lecture 11

Refactoring Patterns

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Organizing Data: *Self Encapsulate Field*

- **Self Encapsulate Field**
  - You are accessing a field directly, but the coupling to the field is becoming awkward.
  - *Create getting and setting methods for the field and use only those to access the field.*

```java
private int _low, _high;
boolean includes (int arg) {
    return arg >= _low && arg <= _high;
}
```

```java
private int _low, _high;
boolean includes (int arg) {
    return arg >= getLow() && arg <= getHigh();
}
int getLow() {return _low;}
int getHigh() {return _high;}
```
Organizing Data: *Replace Data Value with Object*

- **Replace Data Value with Object**
  - You have a data item that needs additional data or behavior.
  - *Turn the data item into an object.*
Organizing Data: Replace Array with Object

- **Replace Array with Object**
  - You have an array in which certain elements mean different things.
  - *Replace the array with an object that has a field for each element.*

```java
String[] row = new String[3];
row[0] = "Liverpool";
row[1] = "15";
```

```java
Performance row = new Performance();
row.setName("Liverpool");
row.setWins("15");
```
Organizing Data: *Duplicate Observed Data*

- **Duplicate Observed Data**
  - You have domain data available only in a GUI control, and domain methods need access.
  - Copy the data to a domain object. Set up an observer to synchronize the two pieces of data.
Organizing Data: *Encapsulate Field*

- **Encapsulate Field**
  - There is a public field.
  - *Make it private and provide accessors.*

```java
public String _name

private String _name;
public String getName() {return _name;}
public void setName(String arg) {_name = arg;}
```
Organizing Data: *Encapsulate Collection*

- **Encapsulate Collection**
  - A method returns a collection.
  - *Make it return a read-only view and provide add/remove methods.*

![Diagram showing the concept of encapsulating a collection with methods to add and remove courses.](image-url)
Organizing Data: \textit{Replace Subclass with Fields}

- \textbf{Replace Subclass with Fields}
  - You have subclasses that vary only in methods that return constant data.
  - \textit{Change the methods to superclass fields and eliminate the subclasses.}
Simplifying Conditional Expressions: Decompose Conditional

- Decompose Conditional
  - You have a complicated conditional (if-then-else) statement.
  - Extract methods from the condition, then part, and else parts.

```java
if (date.before(SUMMER_START) || date.after(SUMMER_END))
    charge = quantity * _winterRate + _winterServiceCharge;
else charge = quantity * _summerRate;

downarrow

if (notSummer(date))
    charge = winterCharge(quantity);
else charge = summerCharge(quantity);
```
Simplifying Conditional Expressions: *Consolidate Conditional Expression*

- **Consolidate Conditional Expression**
  - You have a sequence of conditional tests with the same result.
  - *Combine them into a single conditional expression and extract it.*

```java
double disabilityAmount() {
    if (_seniority < 2) return 0;
    if (_monthsDisabled > 12) return 0;
    if (_isPartTime) return 0;
    // compute the disability amount
}
```

```java
double disabilityAmount() {
    if (isNotEligableForDisability()) return 0;
    // compute the disability amount
}
```
Simplifying Conditional Expressions: *Replace Nested Conditional with Guards*

- **Replace Nested Conditional with Guard Clauses**
  - A method has conditional behavior that does not make clear the normal path of execution.
  - *Use guard clauses for all the special cases.*

```java
double getPayAmount() {
    double result;
    if (_isDead) result = deadAmount();
    else {
        if (_isSeparated) result = separatedAmount();
        else {
            if (_isRetired) result = retiredAmount();
            else result = normalPayAmount();
        }
    }
    return result;
}
```

```java
// Refactored version
double getPayAmount() {
    if (_isDead) return deadAmount();
    if (_isSeparated) return separatedAmount();
    if (_isRetired) return retiredAmount();
    return normalPayAmount();
}
```
Simplifying Conditional Expressions: Replace Conditional with Polymorphism

- **Replace Conditional with Polymorphism**
  - You have a conditional that chooses different behavior depending on the type of an object.
  - *Move each leg of the conditional to an overriding method in a subclass. Make the original method abstract.*

```java
double getSpeed() {
    switch (_type) {
    case EUROPEAN:
        return getBaseSpeed();
    case AFRICAN:
        return getBaseSpeed() - getLoadFactor() * _numberOfCoconuts;
    case NORWEGIAN_BLUE:
        return (_isNailed) ? 0 : getBaseSpeed(_voltage);
    }
    throw new RuntimeException("Should be unreachable");
}
```

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Simplifying Conditional Expressions: *Introduce Null Object*

- **Introduce Null Object**
  - You have repeated checks for a null value.
  - *Replace the null value with a null object.*

```java
if (customer == null) plan = BillingPlan.basic();
else plan = customer.getPlan();
```
Making Method Calls Simpler: Separate Query from Modifier

- Separate Query from Modifier
  - You have a method that returns a value but also changes the state of an object.
  - *Create two methods, one for the query and one for the modification.*
Making Method Calls Simpler: $Parameterize\ Method$

- **Parameterize Method**
  - Several methods do similar things but with different values contained in the method body.
  - *Create one method that uses a parameter for the different values.*
Making Method Calls Simpler: *Replace Parameter with Explicit Methods*

- **Replace Parameter with Explicit Methods**
  - You have a method that runs different code depending on the values of an enumerated parameter.
  - *Create a separate method for each value of the parameter.*

```java
void setValue (String name, int value) {
    if (name.equals("height"))
        _height = value;
    if (name.equals("width"))
        _width = value;
    Assert.shouldNeverReachHere();
}
```

```java
void setHeight(int arg) {
    _height = arg;
}
void setWidth(int arg) {
    _width = arg;
}
```

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Making Method Calls Simpler: *Preserve Whole Object*

- **Preserve Whole Object**
  - You are getting several values from an object and passing these values as parameters in a method call.
  - *Send the whole object instead.*

```java
int low = daysTempRange().getLow();
int high = daysTempRange().getHigh();
withinPlan = plan.withinRange(low, high);
```

```java
withinPlan = plan.withinRange(daysTempRange());
```
Making Method Calls Simpler: Replace Parameter with Method

- **Replace Parameter with Method**
  - An object invokes a method, then passes the result as a parameter for a method. The receiver can also invoke this method.
  - *Remove the parameter and let the receiver invoke the method.*

```java
int basePrice = _quantity * _itemPrice;
discountLevel = getDiscountLevel();
double finalPrice = discountedPrice (basePrice, discountLevel);
```

```java
int basePrice = _quantity * _itemPrice;
double finalPrice = discountedPrice (basePrice);
```
Making Method Calls Simpler: *Introduce Parameter Object*

- **Introduce Parameter Object**
  - You have a group of parameters that naturally go together.
  - *Replace them with an object.*

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![Diagram showing the introduction of a parameter object](image)

<table>
<thead>
<tr>
<th>Customer</th>
</tr>
</thead>
<tbody>
<tr>
<td>amountInvoicedIn(start: Date, end: Date)</td>
</tr>
<tr>
<td>amountReceivedIn(start: Date, end: Date)</td>
</tr>
<tr>
<td>amountOverdueIn(start: Date, end: Date)</td>
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![Diagram showing the parameter object introduction](image)

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Reference