



Core Principles

Definition

Refactoring: Improving the internal structure of existing code without changing its external behavior.

Benefits

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| Improved Design | Easier to understand, modify, and extend the code. |
| Reduced Complexity | Simplifies code, making it less prone to errors. |
| Enhanced Maintainability | Reduces the cost of future development and bug fixes. |
| Increased Performance | Can sometimes improve code execution speed. |

When to Refactor

- **The Rule of Three:** Refactor after you've done something similar three times.
- **When Adding Functionality:** Refactor to make it easier to add new features.
- **When Fixing a Bug:** Refactor to prevent similar bugs in the future.
- **During Code Review:** Identify areas that can be improved.

Key Refactoring Techniques

Composing Methods

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| Extract Method | Create a new method from a code fragment. Example: Isolating a complex calculation into its own function. |
| Inline Method | Replace a method call with the method's content. Example: Removing a simple method that doesn't add value. |
| Replace Temp with Query | Replace a temporary variable with a method. Example: Calculating a value on demand instead of storing it. |

Moving Features Between Objects

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| Move Method | Move a method to another class that it uses more. Example: Moving a method that uses more features of another class to that class. |
| Move Field | Move a field to another class that it is used by. Example: Moving a field to the class where it's primarily accessed. |
| Extract Class | Create a new class and move related fields and methods from an existing class. Example: Separating UI logic from business logic. |
| Inline Class | Move all features from a class into another. Example: When a class is no longer complex enough to warrant its own existence. |

Organizing Data

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| Replace Data Value with Object | Replace a data value with an object. Example: Using an object to represent a simple value like a phone number or zip code. |
| Change Value to Reference | Change a value object to a reference object. Example: Using a single <code>Customer</code> object instead of creating new ones with the same data. |
| Change Unidirectional Association to Bidirectional | Add a back pointer in association. Example: Making parent and child objects aware of each other. |

Simplifying Conditional Expressions

Decompose Conditional

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| Description | Separate the 'then' and 'else' parts of a conditional into distinct methods. |
| Motivation | Improves readability and allows for easier modification of individual branches. |
| Example | Turning a large if-else block into smaller, named methods. |

Consolidate Conditional Expression

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| Description | Replace a sequence of conditional expressions with a single conditional expression. |
| Motivation | Makes the code easier to understand when multiple conditions lead to the same result. |
| Example | Combining several <code>if</code> statements that return the same value. |

Replace Nested Conditional with Guard Clauses

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| Description | Replace nested conditional statements with guard clauses. |
| Motivation | Makes the code more readable by exiting early for special cases. |
| Example | Using <code>return</code> statements at the beginning of a method to handle edge cases. |

Dealing with Inheritance

Pull Up Field

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| Description | Move a field to the superclass. |
| Motivation | Eliminates duplication when subclasses have the same field. |
| Example | Moving a common property like <code>name</code> to the parent class. |

Pull Up Method

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| Description | Move a method to the superclass. |
| Motivation | Avoids code duplication when subclasses have similar methods. |
| Example | Moving a <code>calculateSalary</code> method to the parent class. |

Push Down Method

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| Description | Move a method from the superclass to subclasses. |
| Motivation | Allows specialized behavior in subclasses without cluttering the superclass. |
| Example | Moving a specialized method like <code>displayImage</code> to subclasses that need it. |

Replace Inheritance with Delegation

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| Description | Create a field on the class that refers to the original class and delegate methods to it. |
| Motivation | Reduces tight coupling between classes and allows more flexible composition. |
| Example | Instead of inheriting behavior, use an object of another class to perform certain actions. |