The Strategy
Design Pattern

For details see Gamma et al. in “Design Patterns”
The Strategy Design Pattern

Intent & Example

Define a family of algorithms, encapsulate each one, and make them interchangeable. Strategy lets the algorithm vary independently from clients that use it.
Define a family of algorithms, encapsulate each one, and make them interchangeable. Strategy lets the algorithm vary independently from clients that use it.
The Strategy Design Pattern

General Structure

Define a family of algorithms, encapsulate each one, and make them interchangeable.
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Strategy - An Alternative to Subclassing

• Subclassing Context mixes algorithm’s implementation with that of Context
  Context harder to understand, maintain, extend.

• When using subclassing we can't vary the algorithm dynamically

• Subclassing results in many related classes
  Only differ in the algorithm or behavior they employ.

• Encapsulating the algorithm in Strategy...
  • lets you vary the algorithm independently of its context
  • makes it easier to switch, understand, reuse and extend the algorithm

If you would use subclassing instead of the Strategy Design Pattern.
Example - “The Strategy Pattern” in Java AWT/Swing

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### Client Code

```java
java.awt.Container c = ...;
c.setLayout(new java.awt.BorderLayout());
```

```java
class Container extends Component {
    ...  
    /**
     * Sets the layout manager for this container.
     * @param mgr the specified layout manager
     */
    public void setLayout(LayoutManager mgr) {
        layoutMgr = mgr;
        invalidateIfValid();
    }

    /**
     * Causes this container to lay out its components. ...
     */
    public void doLayout() {
        LayoutManager layoutManager = this.layoutMgr;
        if (layoutMgr != null) {
            layoutManager.layoutContainer(this);
        }
    }
}
```
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When to use Strategy

• ...many related classes differ only in their behavior rather than implementing different related abstractions
  Strategies allow to configure a class with one of many behaviors.

• ...you need different variants of an algorithm
  Strategies can be used when variants of algorithms are implemented as a class hierarchy.

• ...a class defines many behaviors that appear as multiple conditional statements in its operations
  Move related conditional branches into a strategy.
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Things to Consider

- Clients must be aware of different strategies and how they differ, in order to select the appropriate one
- Clients might be exposed to implementation issues
- Use Strategy only when the behavior variation is relevant to clients
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Things to Consider

• Optional Strategy objects
  • Context checks if it has a Strategy before accessing it...
    • If yes, Context uses it normally
    • If no, Context carries out default behavior
  • Benefit: clients don't have to deal with Strategy objects unless they don't like the default behavior
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Things to Consider

• Increased number of (strategy) objects
• Sometimes can be reduced by stateless strategies that Contexts can share
• Any state is maintained by Context, passes it in for each request to the Strategy object (No / less coupling between Strategy implementations and Context.)
• Shared strategies should not maintain state across invocations (→Services)
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Implementation

The Strategy interface is shared by all Concrete Strategy classes whether the algorithms they implement are trivial or complex.

Some ConcreteStrategies won't use all the information passed to them.
(Simple ConcreteStrategies may use none of it.) (Context creates/initializes parameters that never get used.) If this is an issue use a tighter coupling between Strategy and Context; let Strategy know about Context.
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Implementation

Giving Strategy Visibility for the Context Information the Strategy needs

Two possible strategies:

- Pass the needed information as a parameter...
  - Context and Strategy decoupled
  - Communication overhead
  - Algorithm can’t be adapted to specific needs of context

- Context passes itself as a parameter or Strategy has a reference to its Context...
  - Reduced communication overhead
  - Context must define a more elaborate interface to its data
  - Closer coupling of Strategy and Context
Using the strategy pattern, both - the template and the detailed implementations - depend on abstractions (interfaces).