Advanced Programming Techniques

Design Patterns

Christopher Moretti

Design Pattern Inspirations

- Cultural anthropology
  - idea of quality that transcends individual's personal beliefs, preferences
- Archaeology
  - patterns appear over and over again transcending time, geography, culture

Design Patterns in Architecture

- Christopher Alexander asks "is quality objective?"

  - *Timeless Way of Building,* 1979

  - His answer is yes:
    "Each pattern describes a problem which occurs over and over again in our environment and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice."
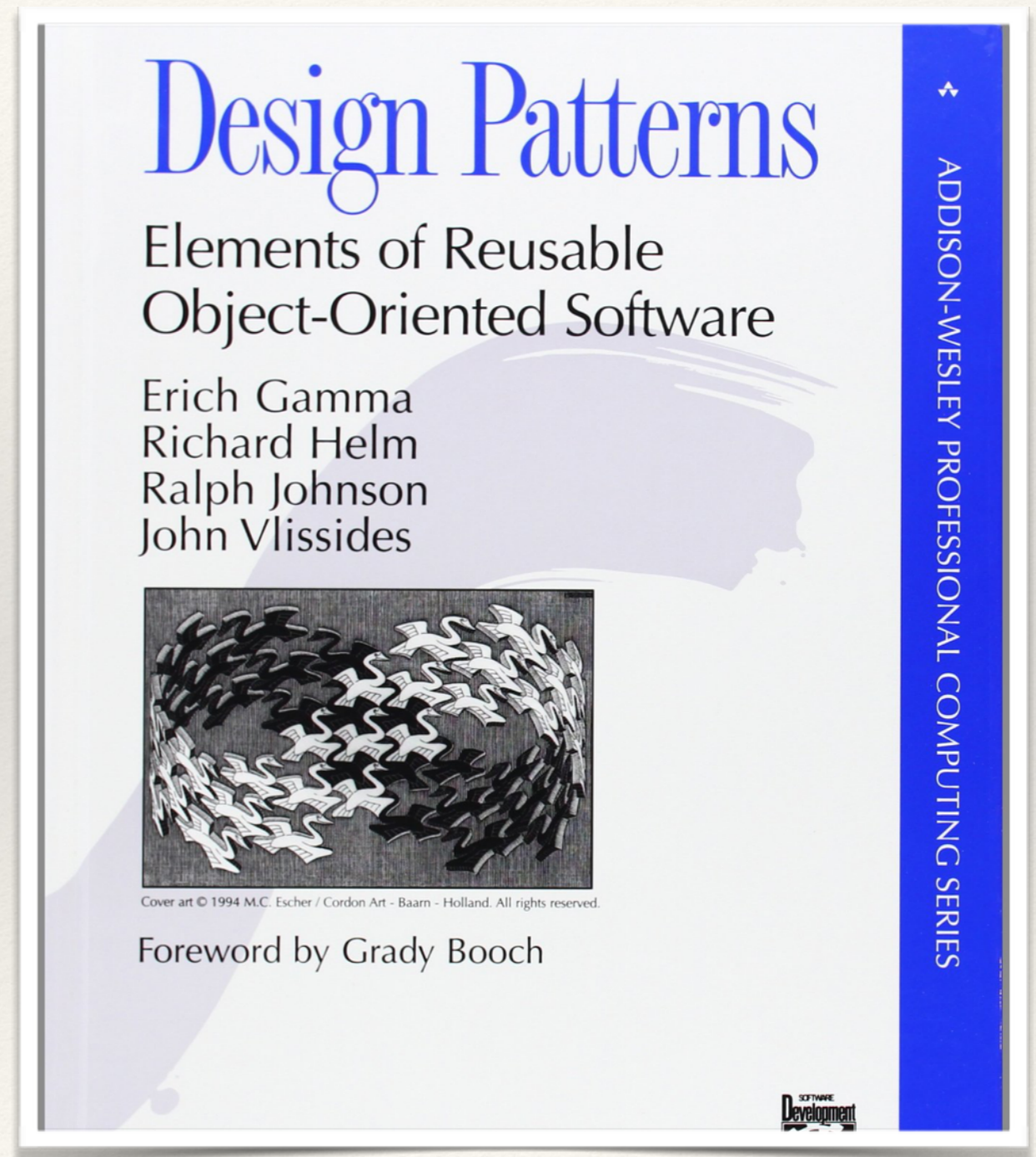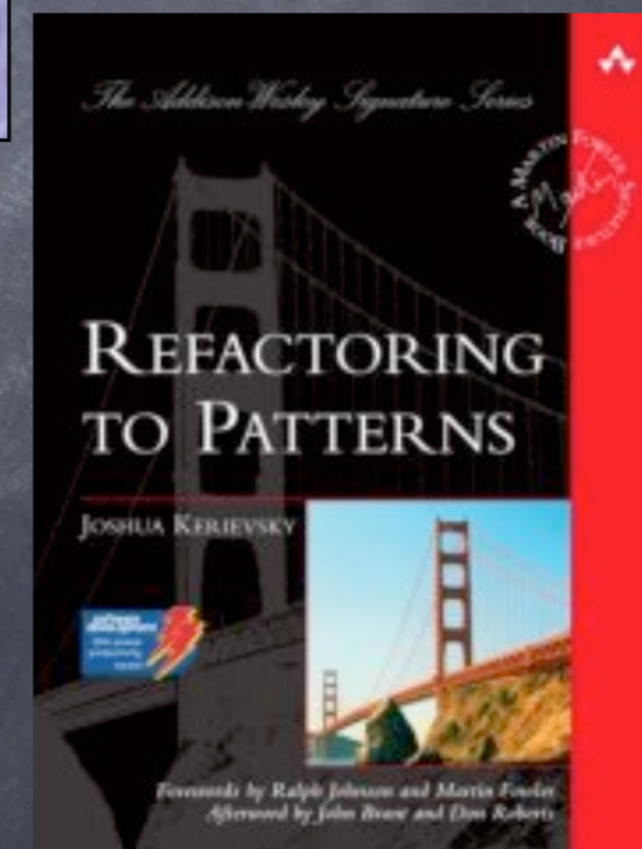
```
intersect(
```


,


```
)
```
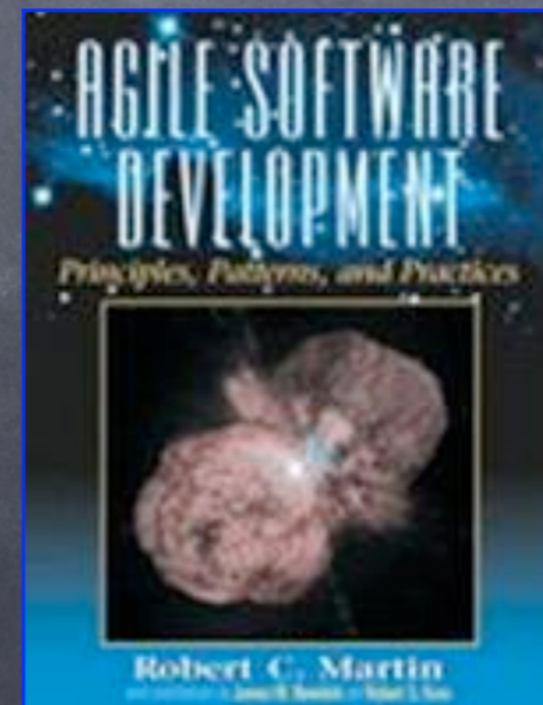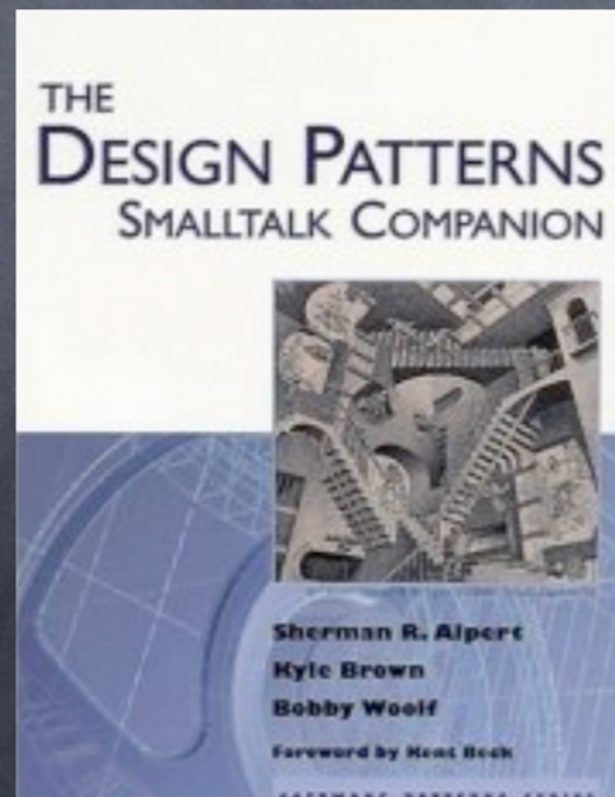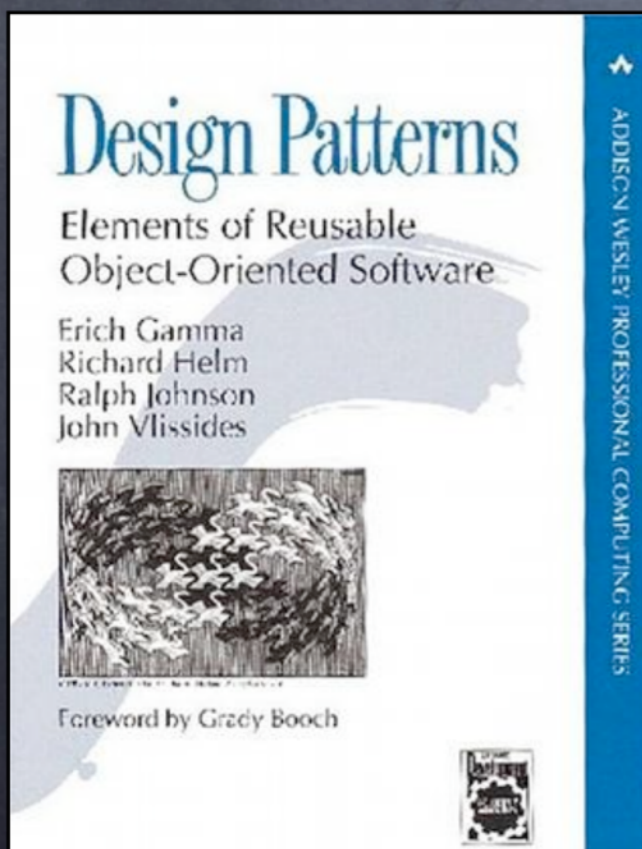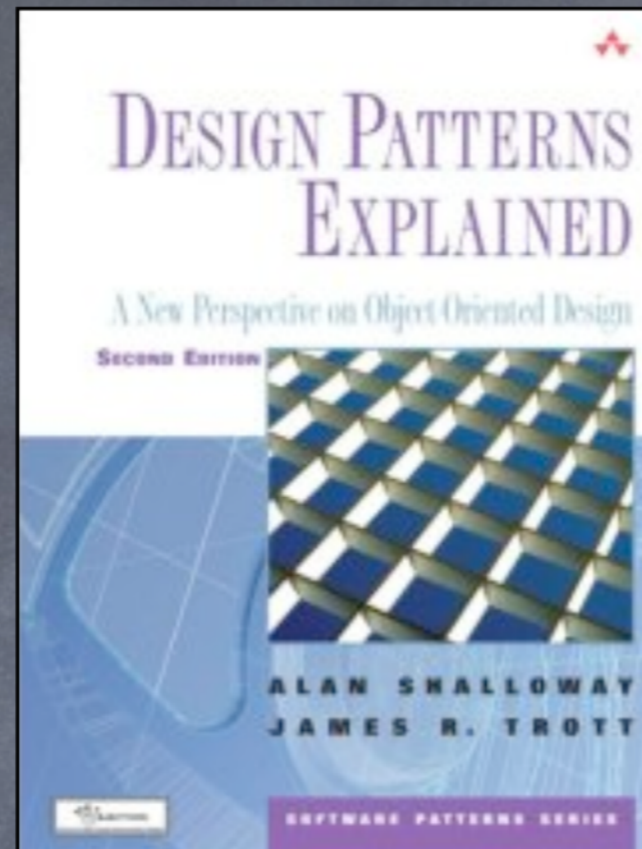
Software Design Patterns

❖ Is the same analysis possible for software engineering?

   ❖ What is present in good systems that is absent in poor systems (X)?

   ❖ What is present in poor systems that is absent in good systems (Y)?

   ❖ Can we design to maximize X and minimize Y?

❖ 1995 "Gang of Four" book

Alex Martelli (aleax.it)

Software Design Patterns

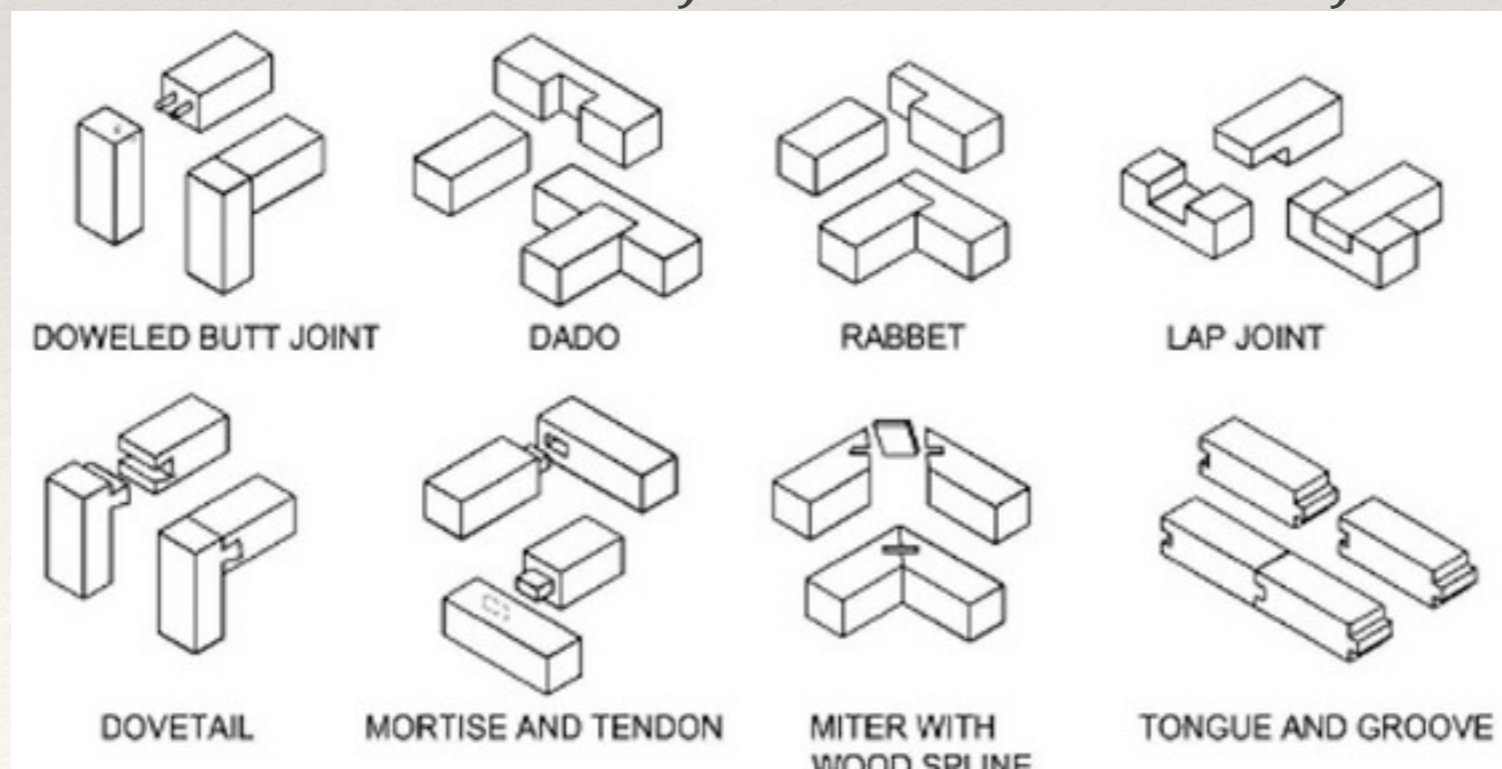❖ Not *just* about making good end products!

Carpenter Analogy

Option 1:

Should I make the joint by cutting down into the wood and then going back up 45 degrees and...

Option 2:

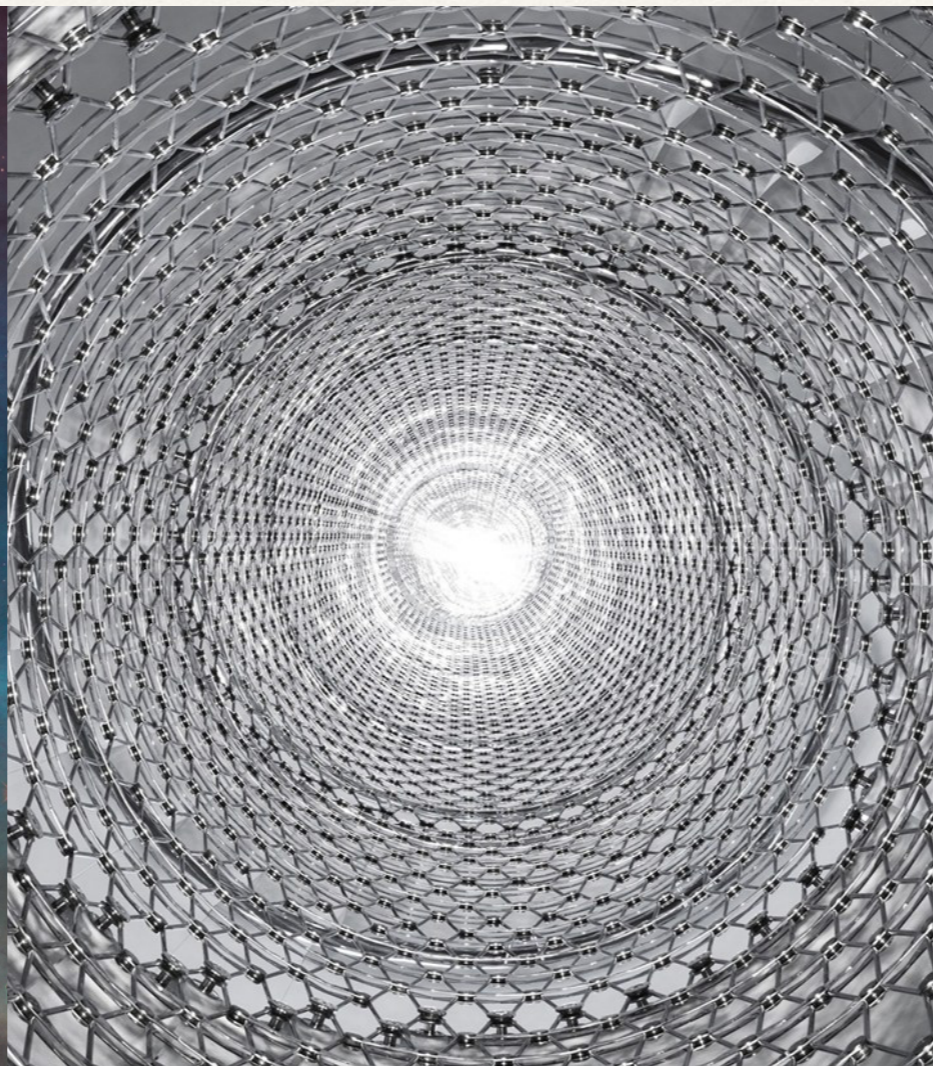Should we use a dovetail joint or a miter joint?

DOWELED BUTT JOINT   DADO   RABBET   LAP JOINT

DOVETAIL   MORTISE AND TENDON   MITER WITH WOOD SPLINE   TONGUE AND GROOVE

Three Types of Design Patterns

Creational   Structural   Behavioral

Creational Design Patterns

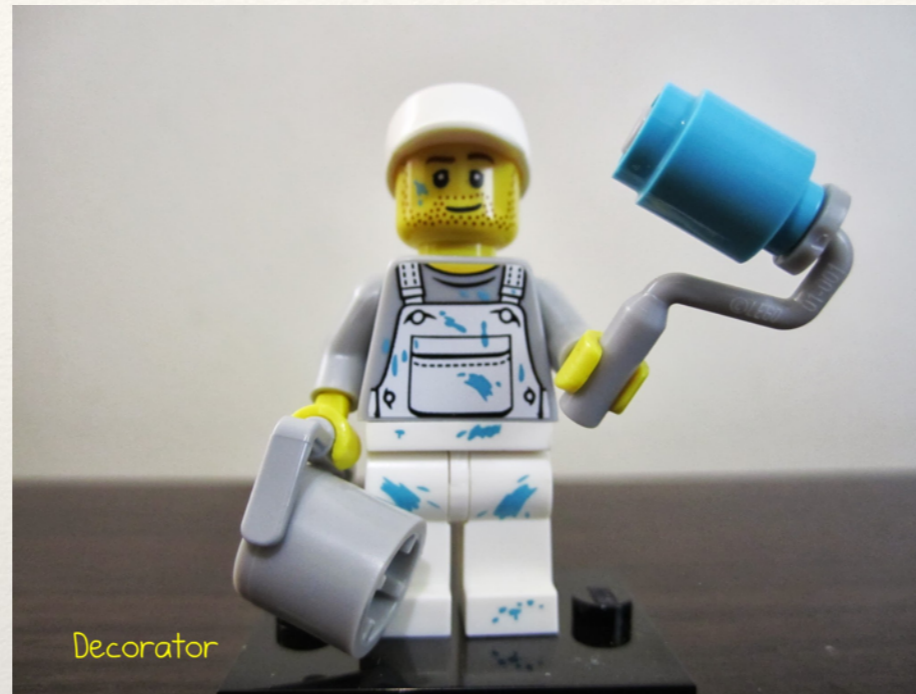Prototype   Singleton   Factory

Factory Example

```
public class AccountFactory {

public static Account newAccount(Type t, String netid) {
 if(t.isStudent) return new Google(netid)
 else if(t.isFac) return new Exchange(netid)
 else return null
}
```
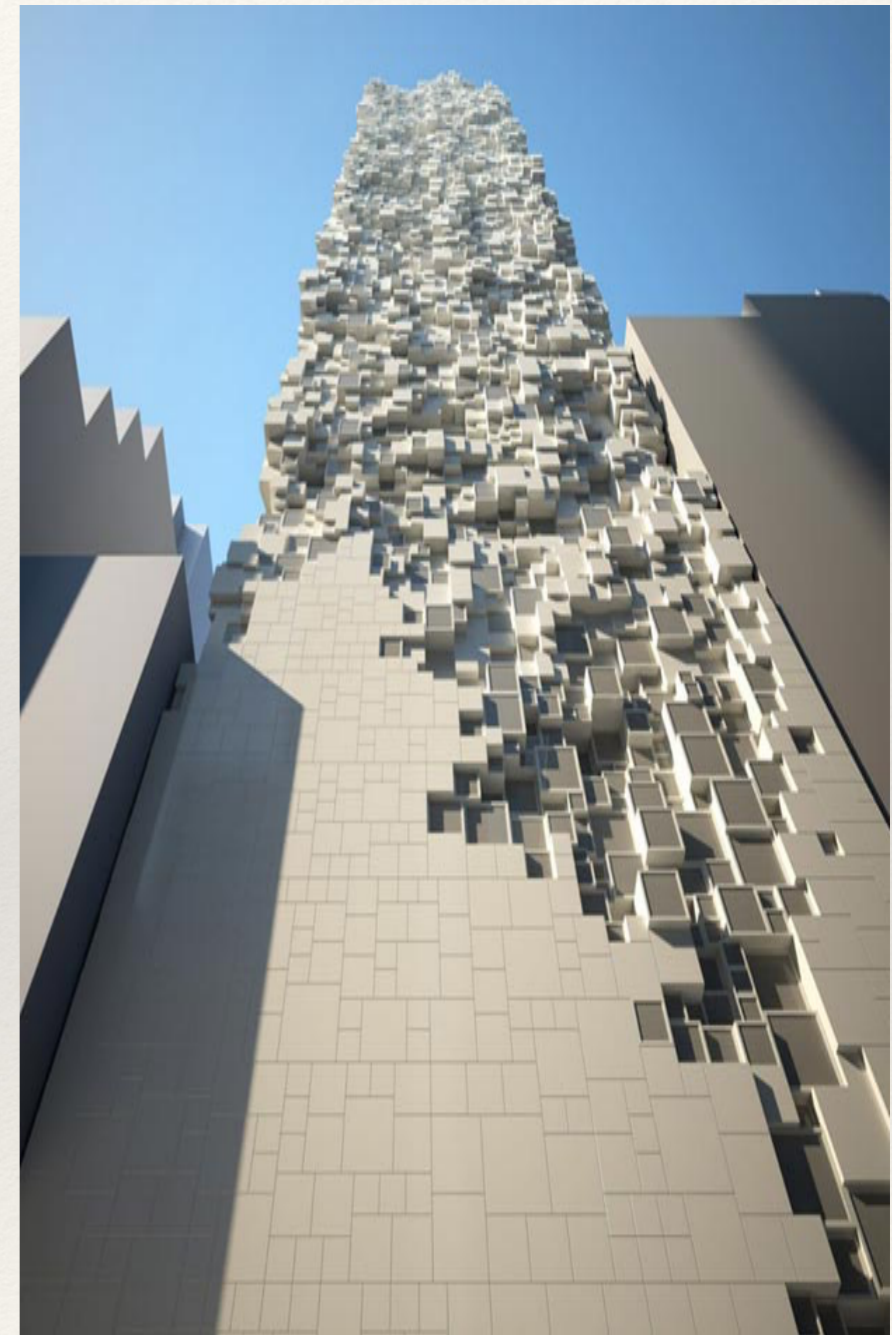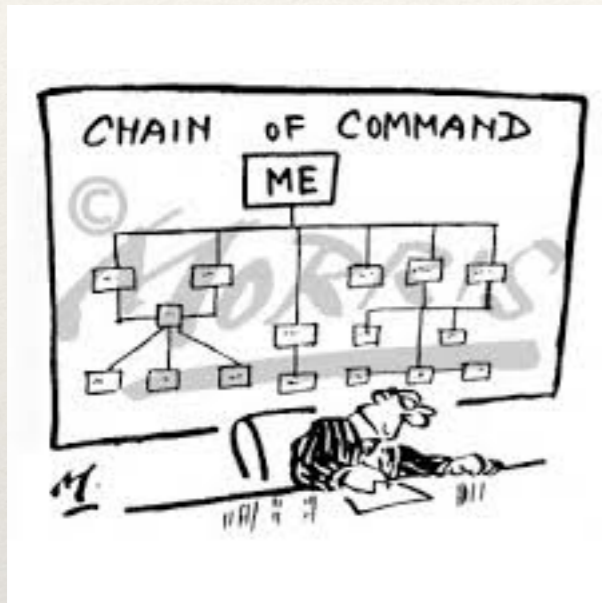
Structural Design Patterns

Proxy

Decorator

Adaptor

Façade

Behavioral Design Patterns

Chain of Responsibility

Iterator

State

Strategy

Observer

Memento