

Message Sends are Plans for Reuse

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About this lecture

- Related to:
 - 'Sending a message is making a choice' and
 - self semantics
- Relevant to any object-oriented language
- Another essential aspect of object-oriented design



What you will learn

- Message sends are **hooks** for subclasses
- Message sends are places where code of subclasses can be invoked



Let's start thinking

Anecdotes

- *I like big methods because I can see all the code*
- *I do not like small methods*

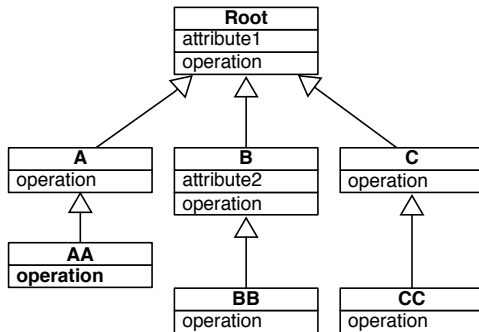
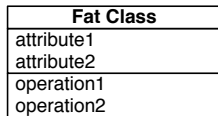
Questions

- Why large methods lead to *under-optimal* design?
- Why writing small methods is a sign of good design?



Remember...

- A message send makes a choice
- A class hierarchy defines the possible choices
- self **always represents the receiver**
- Method lookup starts in the **class of the receiver** (except for super)



An example

```
Node >> setWindowWithRatioForDisplay  
| defaultNodeSize |  
defaultNodeSize := mainCoordinate / maximizeViewRatio.  
self window add: (UINode new with: bandWidth * 55 / defaultWindowSize).  
previousNodeSize := defaultNodeSize.
```

What are the possible solutions to change the `defaultNodeSize` formula in a subclass?



Bad solution: duplication

Duplicate the code in a subclass

```
Node << #NodeWithMargins
```

```
...
```

```
NodeWithMargins >> setWindowWithRatioForDisplay  
| defaultNodeSize |  
defaultNodeSize := (mainCoordinate / maximizeViewRatio) + 10.  
self window add: (UINode new with: bandWidth * 55 / defaultWindowSize).  
previousNodeSize := defaultNodeSize.
```



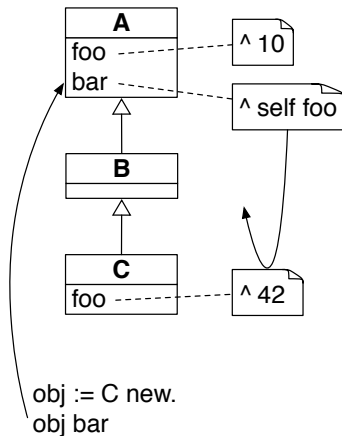
Avoid duplication

- Duplication is not a good practice:
 - duplication copies bugs
 - changing one copy requires changing others
- Note that in Java-like languages, using `private` attributes makes duplication in subclasses impossible



Essence of a better solution

- Define small methods for each aspects
- Send messages to self
- Subclasses can override such methods



Applying it to our example

We can refactor this:

```
Node >> setWindowWithRatioForDisplay  
| defaultNodeSize |  
defaultNodeSize := (mainCoordinate / maximizeViewRatio).  
self window add: (UINode new with: bandWidth * 55 / defaultWindowSize).  
previousNodeSize := defaultNodeSize.
```

into:

```
Node >> setWindowWithRatioForDisplay  
| defaultNodeSize |  
defaultNodeSize := self ratio.  
self window add: (UINode new with: bandWidth * 55 / defaultWindowSize).  
previousNodeSize := defaultNodeSize.
```

```
Node >> ratio  
^ mainCoordinate / maximizeViewRatio
```



Subclasses can now reuse the superclass logic

```
Node >> ratio  
  ^ mainCoordinate / maximizeViewRatio
```

A subclass can redefine this behavior into:

```
NodeWithMargins >> ratio  
  ^ super ratio + 10
```

- In general there is no real need to invoke `super ratio`, but in our example this is better
- `defaultNodeSize` is computed when we execute:

```
NodeWithMargins new setWindowWithRatioForDisplay
```



Another step

```
Node >> setWindowWithRatioForDisplay  
| defaultNodeSize |  
defaultNodeSize := self ratio.  
self window add: (UINode new with: bandWidth * 55 / defaultWindowSize).  
previousNodeSize := defaultNodeSize.
```

How to use a different UINode in subclasses?



Another step: same solution applied

Extract the `UINode` instantiation into a separate method.

```
Node >> setWindowWithRatioForDisplay  
| defaultNodeSize |  
defaultNodeSize := self ratio.  
self window add: self createUINode.  
previousNodeSize := defaultNodeSize.
```

```
Node >> createUINode  
^ UINode new with: bandwidth * 55 / defaultWindowSize
```



Improvement: do not hardcode class use

Refactor this:

```
Node >> createUINode  
  ^ UINode new with: bandWidth * 55 / defaultWindowSize
```

into:

```
Node >> createUINode  
  ^ self uiNodeClass new with: bandWidth * 55 / defaultWindowSize.
```

```
Node >> uiNodeClass  
  ^ UINode
```

- Subclasses can change UI node class
- Good practice to define methods that return classes
- BTW, easy in Pharo because classes are regular objects!

Many take-aways

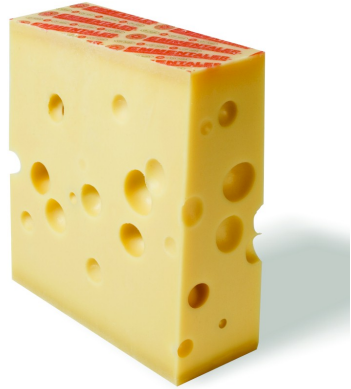
Small methods are a sign of good design, because:

- they give a **name** to expressions
- they encapsulate complexity (no need to read all method definitions) if their name is meaningful
- they ease testing
- they support self-send messages
- self-send messages are potential **hooks** for extensibility in subclasses (redefinition)



Emmental-oriented programming

Object-oriented programming is
Emmental-oriented programming!
Subclasses fill up the holes



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Conclusion

- Code can be reused and refined in subclasses
- Sending a message to `self` in a class defines a **hook**:
 - i.e. a place where subclasses can **inject variations**
- Prefer **small** methods because:
 - it gives names to expressions
 - each message to a small method is an extensibility point for subclasses



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Advanced Object-Oriented Design and Development with Pharo

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