

Hooks and Template

One of the cornerstones of OOP

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Goal/Outline

- Hook and Template methods
- `printString/printOn`: **case**
- The **case** of `copy`



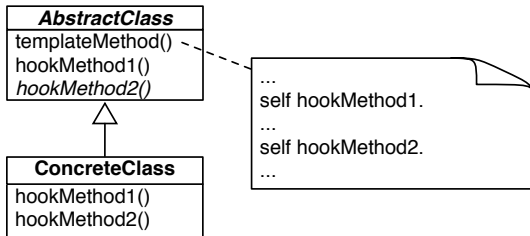
Remember...

- Sending a message is making a choice
- A class defines one possible choice
- Self-sends are plans for reuse
- A self-send defines a hook
 - i.e., a place where subclasses can inject variations

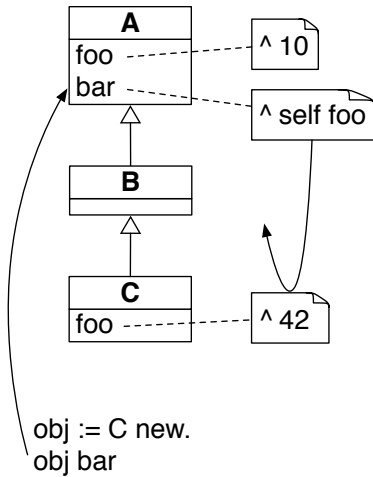


The template method

- A template method specifies a skeleton with hooks
- Hooks are places to be customized by subclasses
- Hooks may or may not have a default behavior



Principle



Studying the printString template method

Example of printString

```
> (Delay forSeconds: 10) printString  
'a Delay(10000 msecs)'
```



The printString template method

```
Object >> printString
```

```
"Answer a String whose characters are a description of the receiver."
```

```
^ self printStringLimitedTo: 50000
```

```
Object >> printStringLimitedTo: limit
```

```
| limitedString |
```

```
limitedString := String
```

```
streamContents: [:s | self printOn: s ]
```

```
limitedTo: limit.
```

```
limitedString size < limit ifTrue: [ ^ limitedString ].
```

```
^ limitedString , '...etc...'
```

Do you see the hook?



printOn: A default hook

```
> Node new printString  
a Node
```

```
> Apple new printString  
an Apple
```

Default behavior:

```
Object >> printOn: aStream  
"Append to the argument, aStream, a sequence of characters that identifies the  
  receiver."  
| title |  
title := self class name.  
aStream  
  nextPutAll: (title first isVowel ifTrue: [ 'an ' ] ifFalse: [ 'a ' ]);  
  nextPutAll: title
```



Hook refinement in Delay

```
> (Delay forSeconds: 1) printString  
a Delay(1000 msecs)
```

Reusing and extending default behavior:

```
Delay >> printOn: aStream  
super printOn: aStream.  
aStream  
  nextPutAll: '(';  
  print: millisecondDelayDuration;  
  nextPutAll: ' msecs)'
```



Hook redefinition in False

```
> true not printString  
false
```

Redefinition in False:

```
False >> printOn: aStream  
aStream nextPutAll: 'false'
```



Hook redefinition in Interval

```
> (1 to: 100) printString  
(1 to: 100)  
> (1 to: 100 by: 3) printString  
(1 to: 100 by: 3)
```

Redefinition in Interval:

```
Interval >> printOn: aStream  
aStream  
  nextPut: $(  
  print: start;  
  nextPutAll: ' to: '  
  print: stop.  
step ~= 1  
  ifTrue: [ aStream nextPutAll: ' by: '; print: step ].  
aStream nextPut: $)
```



Another template method: Object copy

Copying objects is complex:

- graph of connected objects
- cycles
- each class may want a different copy strategy

A simple solution for simple cases: `copy/postCopy`



Object » copy

Object >> copy

"Answer another instance just like the receiver.

Subclasses typically override postCopy.

Copy is a template method in the sense of Design Patterns.

So do not override it. Override postCopy instead. P

ay attention that normally you should call postCopy of your superclass too."

^ self shallowCopy postCopy

Object >> shallowCopy

"Answer a copy of the receiver which shares the receiver's instance variables.

Subclasses that need to specialize the copy should specialize the postCopy hook method."

<primitive: 148>

...



Default hook

Object >> postCopy

"I'm a hook method in the sense of Design Patterns Template/Hook Method.

I'm called by copy.

self is a shallow copy, subclasses should copy fields as necessary to complete the full copy"

^ self



Bag»postCopy: refinement

```
Collection << #Bag  
  slots: { #contents }
```

```
Bag >> postCopy  
  super postCopy.  
  contents := contents copy
```

- contents is a Dictionary
- postCopy recursively invoke copy on the dictionary



Dictionary » postCopy: Deeper copy

Dictionary >> postCopy

"Must copy the associations, or later store will affect both the original and the copy"

```
array := array collect: [ :association |  
    association ifNotNil: [ association copy ] ]
```



Conclusion

- *Hooks and Template* is a very common pattern
- A **template** method sets the context
- **Hooks** specify variations
- A self-send message defines a hook
- Sending a message to another object opens space for dispatch
 - see Strategy Design lecture



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