Introduction to Blocks

Damien Cassou, Stéphane Ducasse and Luc Fabresse
Blocks

Blocks are:

- kind of anonymous methods
  - also called (lexical) closures
- used everywhere in Pharo
  - loops, conditionals, iterators, ...
  - GUI frameworks, DSLs, ...
  - at the heart of the system
- just introduced in Java 8.0
A block is defined by []

[ expressions. ... ]
Block Definition Does not Execute Code

- Executing code may signal an Error

\[
\begin{align*}
(1/0) \\
\rightarrow \text{Error}
\end{align*}
\]

- But, no error when \textbf{defining} a block
  - a block definition does not execute its body
  - a block definition freezes its body computation

\[
\begin{align*}
[1/0] \\
> [1/0]
\end{align*}
\]

\[
\begin{align*}
[1/0]. \\
1+2 \\
> 3
\end{align*}
\]
Executing a block is done **explicitly** through `value`.

\[
\begin{align*}
[2 + 6] & \text{ value} \\
> 8 & \\
\hline
[1 / 0] & \text{ value} \\
> \text{Error} & 
\end{align*}
\]
A Block with 1 Argument

A block can take arguments (just like methods)

```
[ :x | x + 2 ]
```

- `[ ]` delimits the block
- `:x` is a block argument
- `x + 2` is the block body

```
[ :x | x + 2 ] value: 5
> 7
```

- `value: 5` executes the block with 5 as argument
  - `x` is 5 during the block execution
Block execution returns the value of the last expression

\[
[ x | \\
x + 33. \\
x + 2 ] \text{ value: 5}
\]

> 7
Blocks can be Stored

- A block can be stored in a variable
- A block can be evaluated multiple times

```plaintext
| add2 |
add2 := [ :x | x + 2 ].

add2 value: 5.
> 7

add2 value: 33
> 35
```
Defining a Block with 2 Arguments

Example:

```
[:x :y | x + y]
```

`:x :y` are block arguments

How to execute a block with two arguments?

```
[:x :y | x + y] ??? 5 7
> 12
```
Executing a Block with 2 Arguments

[ :x :y | x + y ] value: 5 value: 7
> 12

- value: 5 value: 7 evaluates the block with 5 and 7
  - x is 5 and y is 7 during the block evaluation
A Block with Temporary Variables

Blocks can define temp. variables (just like methods)

```
Collection>>affect: anObject when: aBoolean
  self do: [:index | | args |
    args := ....
    aBoolean
    ifTrue: [ anObject do: args ]
    ifFalse: [ anObject doDifferently: args ] ].
```

- `| args |` defines a temporary variable named `args`
- `args` exists only during block evaluation
Returning from a Block Returns from the Method

When a return `^` is executed in a block, computation exits the method defining the block

```
Integer>>factorial
  "Answer the factorial of the receiver."
  self = 0 ifTrue: [ ^ 1 ].
  self > 0 ifTrue: [ ^ self * (self - 1) factorial ].
  self error: 'Not valid for negative integers'
```

0 factorial
>1

42 factorial
>140500611775287989854314260624451156993638400000000000
A Design Advice

- Use blocks with 2 or 3 arguments maximum
- Define a class instead of a block for more arguments
- A block encapsulates only 1 computation
  - it cannot define more facets (e.g., printing)
Summary on Blocks

[ :variable1 :variable2 ... | 
  | tmp |
  expression1.
  ... variable1 ...
] value: ... value: ...

- Kind of anonymous method
- Technically lexical closures
- Can be stored in variables and method arguments
- Basis of conditionals, loops and iterators (see companion lectures)
- Further readings: http://deepintopharo.org