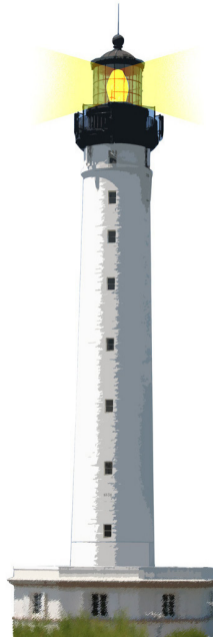


Understanding Messages



Objects, Messages and Closures

- We only manipulate **objects** (mouse, booleans, arrays, numbers, strings, ...)
- We only send them **messages** (@, +, not, getPng:, ifTrue:ifFalse:, new, ...)
- and we use **closures**

Syntax

- Originally invented for kids
- Programs look like little sentences
- Try to minimize the number of parentheses



Example

```
(ZnEasy getPng: 'http://a.tile.openstreetmap.org/8/12/8.png')  
asMorph openInWindow
```

Three Kinds of Messages to Minimize Parentheses

- **Unary message:** receiver selector
 - 9 squared, Date today
- **Binary message:** receiver selector argument
 - 1+2
 - 3@4
- **Keyword message:** receiver key1: arg1 key2: arg2
 - 2 between: 10 and: 20



Message Precedence

(Msg) > Unary > Binary > Keywords

- First we execute ()
- Then unary, then binary and finally keyword messages

This order minimizes () needs
But let us start with messages



Unary Message Examples

anObject aSelector

1 class
> SmallInteger

false not
> true

Date today
> 24 May 2009

Float pi
> 3.141592653589793

Did you notice?

- We sent messages to any objects, including classes!
- There is no difference between sending a message to an object or to a class

```
1 class  
> SmallInteger
```

```
Date today  
> 27 June 2015
```


A Bit of Introspection

Point selectors

```
> #(#x #theta #quadrantOf: #onLineFrom:to:within: #bitShiftPoint: #< #scaleFrom:to:  
    #sideOf: #'\\' #scaleTo: #grid: #'/' #asIntegerPoint #directionToLineFrom:to: ...)
```

- Returns all the messages the class understands



A Little Query

- Let us query the system and only filter the unary messages:

```
Point selectors select: #isUnary
```

```
> #(#x #theta #asIntegerPoint #r #negated #normalized #sign #degrees  
#isIntegerPoint #guarded #fourNeighbors #eightNeighbors #min #max #ceiling  
#normal #asPoint #y #abs #isPoint #angle #transposed #reciprocal #asFloatPoint  
#asNonFractionalPoint #rounded #leftRotated #floor #truncated #hash #deepCopy  
#fourDirections #rightRotated #isSelfEvaluating #asMargin #isZero)
```

- select: is an iterator (see Iterator lecture)
- Easy :-)



Binary Messages

`anObject aBinarySelector anArgument`

- Used for arithmetic, comparison and logical operations
- One, two or three characters taken from:
 - `+ - / \ * ~ < > = @ % | & ! ? ,`

Binary Message Examples

```
1 + 2  
> 3
```

```
2 > 3  
> false
```

```
10@200  
> 10@200
```

```
'Black chocolate' , ' is good'  
> 'Black chocolate is good'
```

Keyword Messages

```
anObject keyword1: arg1 keyword2: arg2
```

equivalent to:

```
receiver.keyword1keyword2(arg1, arg2)
```

Test Yourself!

- 1 log
- Browser open
- 2 raisedTo: 5
- 'hello', 'world'
- 10@20
- point1 x
- point1 distanceFrom: point2



Test Yourself!

- 1 log (**unary**)
- Browser open (**unary**)
- 2 raisedTo: 5 (**keyword**)
- 'hello', 'world' (**binary**)
- 10@20 (**binary**)
- point1 x (**unary**)
- point1 distanceFrom: point2 (**keyword**)



Example: Message setX:

```
10@20 setX: 2  
> 2@20
```

- We change the x value of the receiver (a point)
- No parentheses required

Example: Message at:put:

```
##('Calvin' 'hates' 'Suzie') at: 2 put: 'loves'  
> ##('Calvin' 'loves' 'Suzie')
```

- #(...) creates an array
- at:put: changes the value of the array element.
- arrays start at 1 in Pharo (i.e., first element is at index 1)



Example: Message between:and:

```
12 between: 10 and: 20  
> true
```

- The message `between:and:` is sent to an integer
- Takes two arguments `10` and `20`

Summary

Three kinds of messages: unary, binary and keywords

- Unary
 - 5 factorial
- Binary
 - $2 + 3$
- Keywords-based messages
 - 2 between: 0 and: 10



A course by

S. Ducasse, G. Polito, and Pablo Tesone



Except where otherwise noted, this work is licensed under CC BY-NC-ND 3.0 France
<https://creativecommons.org/licenses/by-nc-nd/3.0/fr/>