# Pharo Syntax in a Nutshell

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### **Getting a Feel About Syntax**

Give you the general feel to get started:

- Overview of syntactical elements and constructs
- Three kinds of messages to minimize parentheses
- Overview of block syntax

This lecture is an **overview**No stress if you do not get it right now!
We will repeat in future lectures

# The Complete Syntax on a Postcard

No need to understand everything! But "everything" is on this screen :)

```
exampleWithNumber: x
 "This method illustrates the complete syntax."
<aMethodAnnotation>
 lу
 true & false not & (nil isNil)
 ifFalse: [ self halt ].
v := self size + super size.
#($a #a 'a' 1 1.0)
 do: [:each | Transcript
      show: (each class name);
      show: (each printString);
      show: ' ' 1.
 ^{\Lambda} X < V
```

#### **Hello World**

'Hello World' as Morph openInWindow

We send the message asMorph to a string and obtain a graphical element that we open in a window by sending it the message openInWindow

## **Getting the Pharo Logo from the Web**

(ZnEasy getPng: 'http://pharo.org/web/files/pharo.png') asMorph openInWindow

- ZnEasy designates a class
  - Class names start with an uppercase character
- Message getPng: is sent to the ZnEasy class with a string as argument
  - getPng: is a keyword message
- 'http://pharo.org/web/files/pharo.png' is a string
- Messages asMorph and openInWindow are executed from left to right

# **Syntactic Elements**

comment	"a comment"
character	\$c \$# \$@
string	'lulu' 'l"idiot'
symbol (unique string)	#mac #+
literal array	#(12 23 36)
integer	1, 2r101
real	1.5 6.03e-34,4, 2.4e7
boolean	true, false
	(instances of True and False)
undefined	nil
	(instance of UndefinedObject)
point	10@120



#### **Essential Constructs**

- Temporary variable declaration: | var |
- Variable assignment: var := aValue
- Separator: message . message
- Return: ^ expression
- Block (lexical closures, a.k.a anonymous method)

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

## **Essence of Pharo Computation**

- Objects (created using messages)
- Messages
- Blocks (anonymous methods)

# Three Kinds of Messages to Minimize Parentheses

- Unary message
  - Syntax: receiver selector
  - 9 squared
  - Date today
- Binary message
  - Syntax: receiver selector argument
  - 1+2
  - 3@4
- Keyword message
  - Syntax: receiver key1: arg1 key2: arg2
  - o 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

### **Sending an Unary Message**

receiver selector

Example

10000 factorial

We send the message factorial to the object 10000

## **Sending a Binary Message**

receiver selector argument

Example

1 + 3

We send the message  $\mbox{+}$  to the object  $\mbox{1}$  with the object  $\mbox{3}$  as argument

### **Sending a Keyword Message**

receiver keyword1: arg1 keyword2: arg2

equivalent to C like syntax

receiver.keyword1keyword2(arg1, arg2)

## **Example: Sending an HTTP Request**

```
ZnClient new
url: 'https://en.wikipedia.org/w/index.php';
queryAt: 'title' put: 'Pharo';
queryAt: 'action' put: 'edit';
get
```

- new is a unary message sent to a class
- url:, queryAt:put: are keyword messages
- get is a unary message
- ; (called a cascade) sends all messages to the same receiver

## **Messages are Everywhere!**

- Conditionals
- Loops
- Iterators
- Concurrency

## **Conditionals are also Message Sends**

#### 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'
```

- ifTrue: is sent to an object, a boolean!
- ifFalse:ifTrue:, ifTrue:ifFalse: and ifFalse: also exist

You can read their implementation, this is not magic!

### **Loops are also Message Sends**

```
1 to: 4 do: [:i | Transcript << i]
> 1
> 2
> 3
> 4
```

- to:do: is a message sent to an integer
- Many other messages implement loops: timesRepeat:, to:by:do:, whileTrue:, whileFalse:, ...

#### With Iterators

We ask the collection to perform the iteration on itself

```
#(12-4-86)
do: [:each | Transcript show: each abs printString; cr]
> 1
> 2
> 4
> 86
```

### **Blocks Look like Functions**

```
fct(x) = x^*x+3

fct := [:x | x^*x+3]
```

fct(2)

fct value: 2



### **Blocks**

Kind of anonymous methods

[:each | Transcript show: each abs printString; cr]

- Are lexical closures
- Are plain objects:
  - can be passed as method arguments
  - o can be stored in variables
  - can be returned

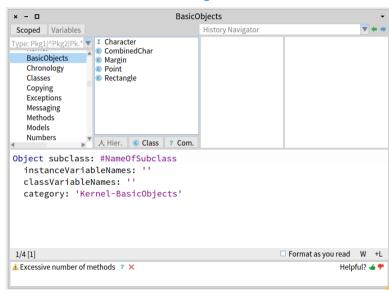
### **Block Usage**

```
#(12-4-86)
do: [:each | Transcript show: each abs printString; cr]
> 1
> 2
> 4
> 86
```

- [] delimits the block
- :each is the block argument
- each will take the value of each element of the array

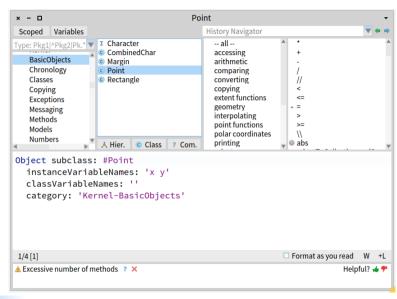


## **Class Definition Template**





### **Class Definition within the IDE**





### **Method Definition**

- Methods are public
- Methods are virtual (i.e., looked up at runtime)
- By default return self

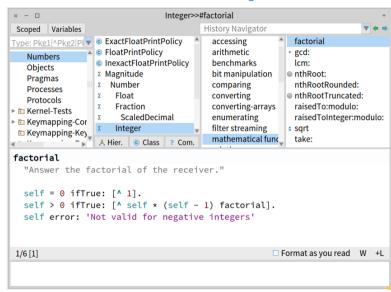
#### messageSelectorAndArgumentNames

"comment stating purpose of message"

| temporary variable names | statements



# **Method Definition Example**





### **Messages Summary**

#### 3 kinds of messages:

- Unary: Node new
- Binary: 1+2, 3@4
- Keywords: 2 between: 10 and: 20

#### Message Priority:

- (Msg) > unary > binary > keyword
- Same-Level messages: from left to right

### **Conclusion**

- Compact syntax
- Few constructs but really expressive
- Mainly messages and closures
- Three kinds of messages
- Support for Domain Specific Languages

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