Pharo:
A Little Journey in the Smalltalk Syntax

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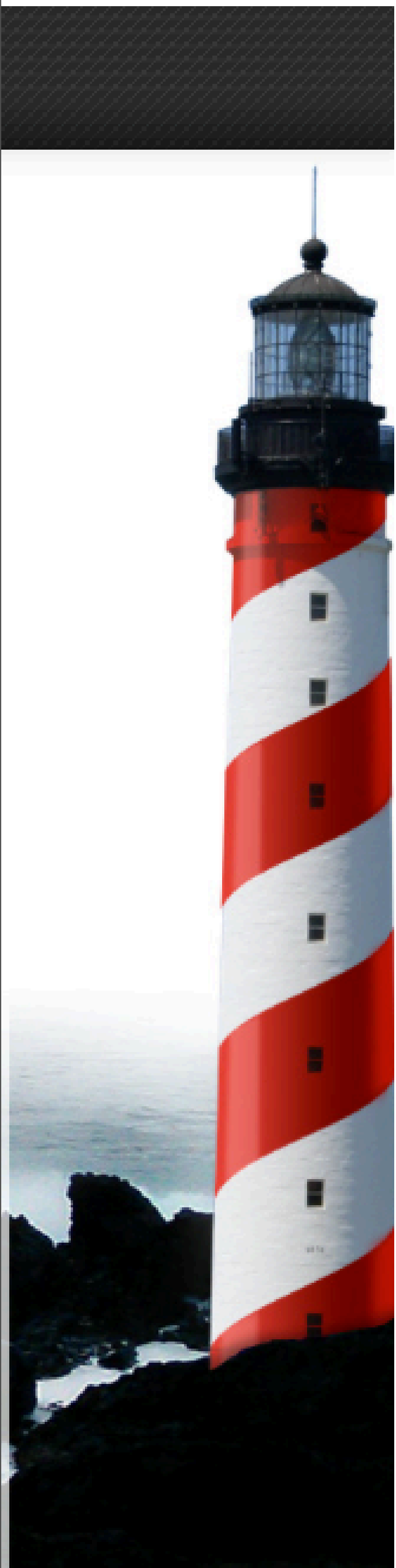
http://www.pharo.org

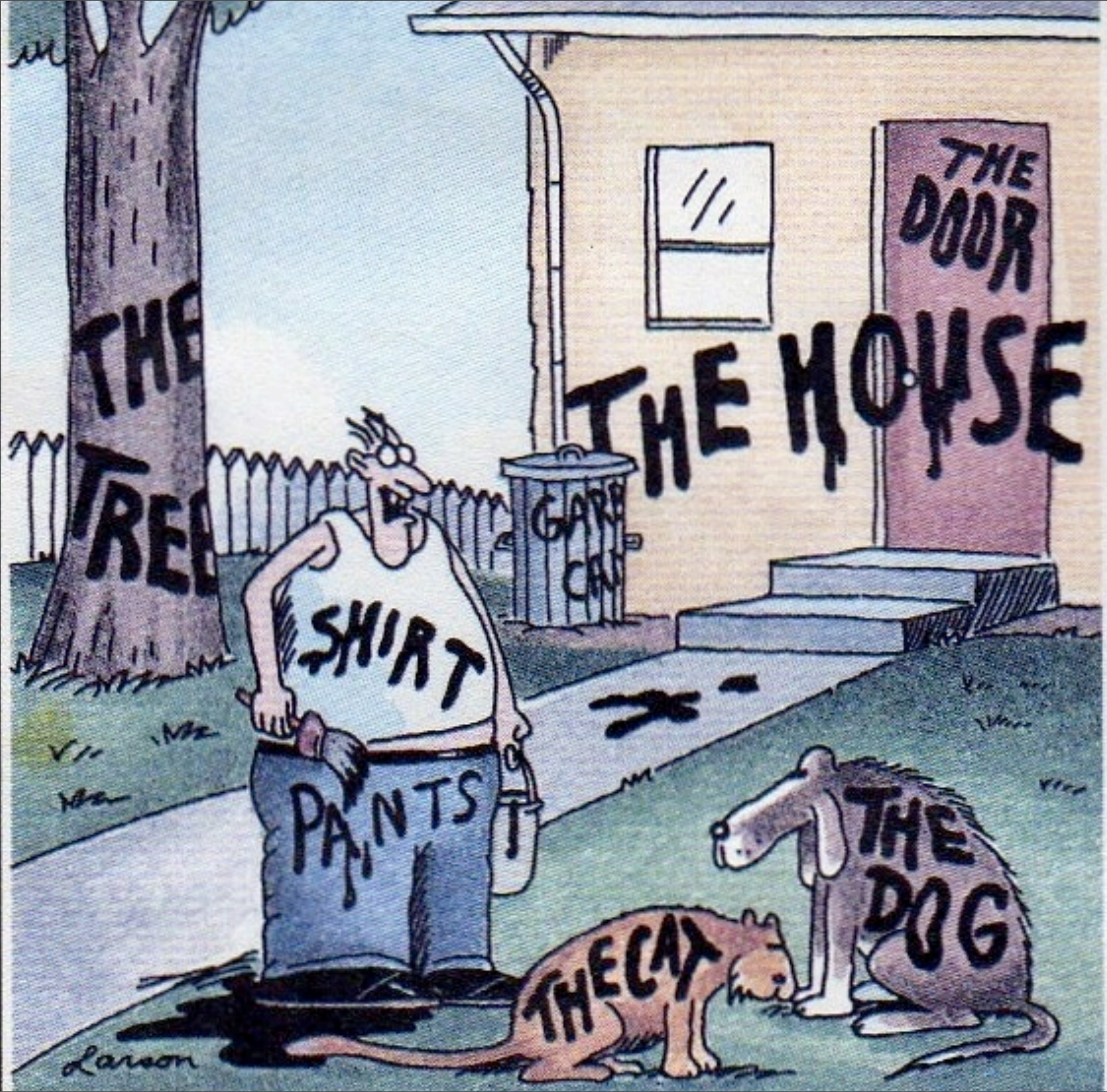


Sensus HighOctane

Show you that this is simple

a piece of cake

a first appetizer


THE TREE
THE HOUSE
THE DOOR
SHIRT
PANTS
THE DOG
THE CAT
Larson

Yeah!

Smalltalk is a dynamically typed language

```
ArrayList<String> strings
        = new ArrayList<String>();
```

strings := ArrayList new.

```
Thread regThread = new Thread(
    new Runnable() {
      public void run() {
          this.doSomething();} });
  regThread.start();
```

[self doSomething] fork.

Smalltalk = Objects + Messages + (...)

Roadmap

Fun with numbers

1 class

1 class

>SmallInteger

1 class maxVal

1 class maxVal

>1073741823

1 class maxVal + 1

1 class maxVal + 1

>1073741824

(1 class maxVal + 1) class

(1 class maxVal + 1) class

>LargePositiveInteger

$(1/3) + (2/3)$

$(1/3) + (2/3)$

>1

$2/3 + 1$

2/3 + 1

> 5/3

1000 factorial

1000 factorial

402387260077093773543702433923003985719374864210714632543799910429938512398629020592044208486969
404800479988610197196058631666872994808558901323829669944590997424504087073759918823627727188732
519779505950995276120874975462497043601418278094646496291056393887437886487337119181045825783647
849977012476632889835955735432513185323958463075557409114262417474349347553428646576611667797396
668820291207379143853719588249808126867838374559731746136085379534524221586593201928090878297308
431392844403281231558611036976801357304216168747609675871348312025478589320767169132448426236131
412508780208000261683151027341827977704784635868170164365024153691398281264810213092761244896359
928705114964975419909342221566832572080821333186116811553615836546984046708975602900950537616475
847728421889679646244945160765353408198901385442487984959953319101723355556602139450399736280750
137837615307127761926849034352625200015888535147331611702103968175921510907788019393178114194545
257223865541461062892187960223838971476088506276862967146674697562911234082439208160153780889893
964518263243671616762179168909779911903754031274622289988005195444414282012187361745992642956581
746628302955570299024324153181617210465832036786906117260158783520751516284225540265170483304226
143974286933061690897968482590125458327168226458066526769958652682272807075781391858178889652208
164348344825993266043367660176999612831860788386150279465955131156552036093988180612138558600301
435694527224206344631797460594682573103790084024432438465657245014402821885252470935190620929023
136493273497565513958720559654228749774011413346962715422845862377387538230483865688976461927383
814900140767310446640259899490222221765904339901886018566526485061799702356193897017860040811889
729918311021171229845901641921068884387121855646124960798722908519296819372388642614839657382291
123125024186649353143970137428531926649875337218940694281434118520158014123344828015051399694290
153483077644569099073152433278288269864602789864321139083506217095002597389863554277196742822248
757586765752344220207573630569498825087968928162753848863396909959826280956121450994871701244516
461260379029309120889086942028510640182154399457156805941872748998094254742173582401063677404595
741785160829230135358081840096996372524230560855903700624271243416909004153690105933983835777939
410970027753472000000000000000000000000000000000000000000000000000000000000000000000000000000000

1000 factorial / 999 factorial

1000 factorial / 999 factorial

> 1000

10 @ 100

10 @ 100

(10 @ 100) x

10 @ 100

(10 @ 100) x

> 10

10 @ 100

(10 @ 100) x

> 10

(10 @ 100) y

10 @ 100

(10 @ 100) x

> 10

(10 @ 100) y

>100

Points!

Points are created using @

Puzzle

(10@100) + (20@100)

Puzzle

(10@100) + (20@100)

>30@200

Puzzle

(10@100) + (20@100)

>30@200

Roadmap

- Fun with characters, strings, arrays

$C $h $a $r $a $c $t $e $r

$F, $Q $U $E $N $T $i $N

Characters? :)

space tab cr ... ?!

- Character space
- Character tab
- Character cr

‘Strings’

‘Tiramisu’

Characters

12 printString

> ’12’

Strings are collections of chars

'Tiramisu' at: 1

Strings are collections of chars

‘Tiramisu’ at: 1

> $T

A program! -- finding the last char

A program!

| str |

A program!

| str | local variable

A program!

```
| str |                                  local variable

str := 'Tiramisu'.
```

A program!

Code	Meaning
`| str |`	local variable
`str := 'Tiramisu'.`	assignment

A program!

```
| str |                         local variable
str := 'Tiramisu'.              assignment
str at: str length
```

A program!

| str | local variable

str := ‘Tiramisu’. assignment

str at: str length message send

> $u

double ‘ to get one

‘L”Idiot’

> one string

For concatenation use ,

‘Calvin’ , ‘ & ‘, ‘Hobbes’

For concatenation use ,

‘Calvin’ , ‘ & ‘, ‘Hobbes’

> ‘Calvin & Hobbes’

For concatenation use ,

‘Calvin’ , ‘ & ‘, ‘Hobbes’

> ‘Calvin & Hobbes’

Symbols: #Pharo

#Something is a symbol

Symbol is a unique string in the system

#Something == #Something

> true

“Comment”

“what a fun language lecture.

I really liked the desserts”

#(Array)

#('Calvin' 'hates' 'Suzie')

#(Array)

#('Calvin' 'hates' 'Suzie') size

#(Array)

#('Calvin' 'hates' 'Suzie') size

> 3

First element starts at 1

```
#('Calvin' 'hates' 'Suzie') at: 2
```

First element starts at 1

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

at: to access, at:put: to set

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

#(Array)

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

> #('Calvin' 'loves' 'Suzie')

Roadmap

- Fun with class definitions

A class definition!

```
Superclass subclass: #Class
    instanceVariableNames: 'a b c'
   ...
    category: 'Package name'
```

A class definition!

```
Object subclass: #Point
    instanceVariableNames: 'x y'
    classVariableNames: ''
    poolDictionaries: ''
    category: 'Graphics-Primitives'
```

A class definition!

```
Object subclass: #Point
    instanceVariableNames: 'x y'
    classVariableNames: ''
    poolDictionaries: ''
    category: 'Graphics-Primitives'
```

Roadmap

- Fun with methods

On Integer

asComplex

"Answer a Complex number that represents value of the the receiver."

```
^ Complex real: self imaginary: 0
```

On Boolean

xor: ***aBoolean***

"Exclusive OR. Answer true if the receiver is not equivalent to aBoolean."

^(self == ***aBoolean***) not

Summary

self, super

can access instance variables

can define local variable | ... |

Do not need to define argument types

^ to return

Roadmap

- Fun with unary messages

1 class

1 class

> SmallInteger

false not

```
false not

> true
```

Date today

Date today

> 24 May 2009

Time now

Time now

> 6:50:13 pm

Float pi

Float pi

> 3.141592653589793

We sent messages to objects or classes!

1 class

Date today

We sent messages to objects or classes!

1 class

Date today

Roadmap

Fun with binary messages

aReceiver aSelector anArgument

Used for arithmetic, comparison and logical operations

One or two characters taken from:

+ - / \ * ~ < > = @ % | & ! ? ,

1 + 2

1 + 2

>3

2 => 3

2 => 3

> false

10 @ 200

‘Black chocolate’ , ‘ is good’

Roadmap

Fun with keyword-based messages

Keyword-based messages

ar := #('Calvin' 'hates' 'Suzie').

arr at: 2 put: 'loves'

Keyword-based messages

ar := #('Calvin' 'hates' 'Suzie').

arr at: 2 put: 'loves'

somehow like arr.atput(2,'loves')

From Java to Smalltalk

```
postman.send(mail,recipient);
```

Removing

```
postman.send(mail,recipient);
```

Removing unnecessary

postman send mail recipient

But without losing information

postman send mail to recipient

```
postman.send(mail,recipient);
```

```
postman send: mail to: recipient
```

```
postman.send(mail,recipient);
```

```
postman send: mail to: recipient
```

#send:to: is the message selector

10@20 setX: 2

10@20 setX: 2

> 2@20

12 between: 10 and: 20

```
12 between: 10 and: 20

> true
```

receiver

keyword1: argument1

keyword2: argument2

equivalent to

receiver.keyword1keyword2(argument1, argument2)

receiver

keyword1: argument1

keyword2: argument2

equivalent to

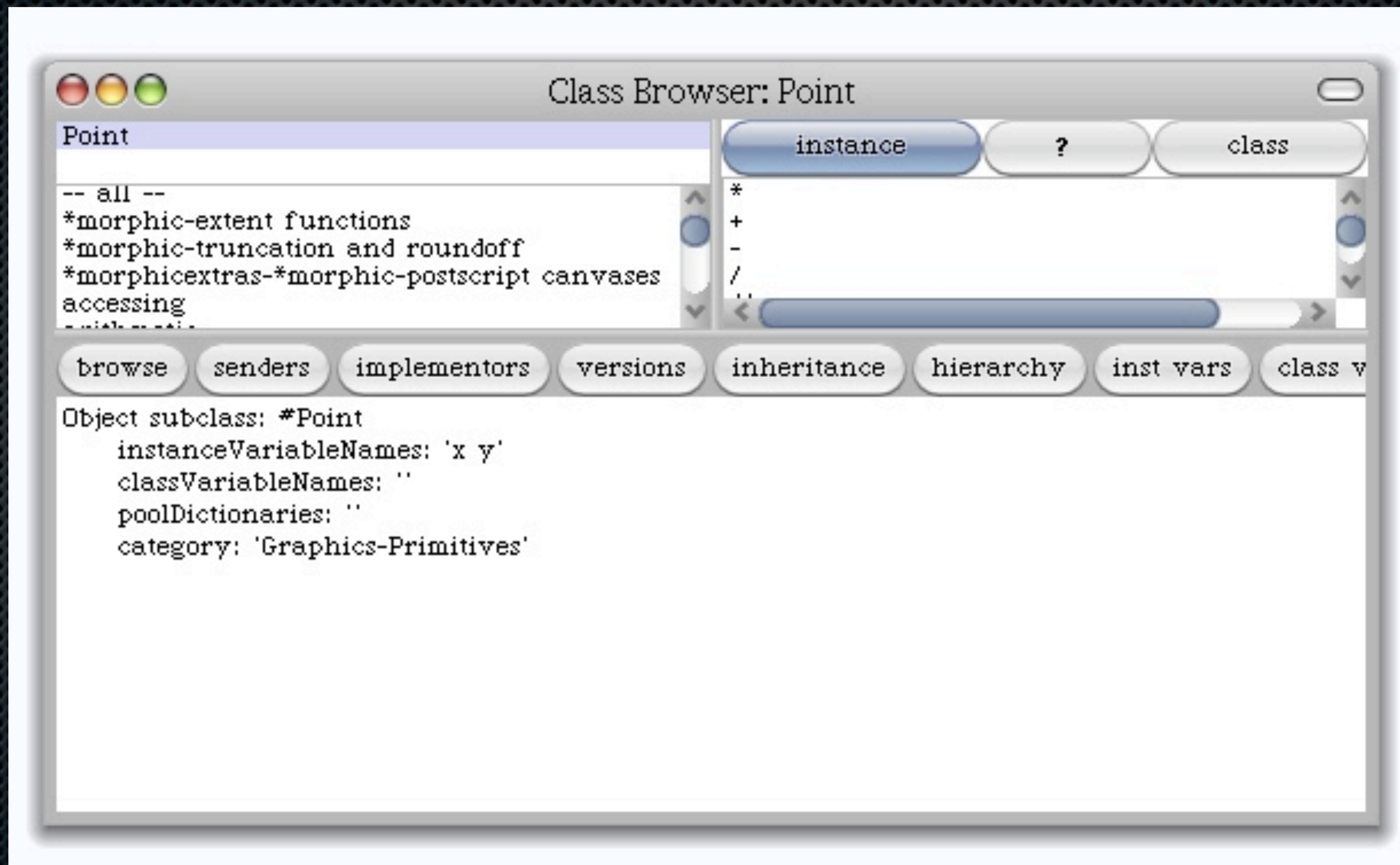
receiver.keyword1keyword2(argument1, argument2)

Roadmap

- Doing/Printing

Browser newOnClass: Point

Browser newOnClass: Point



Yes there is a difference between

doing (side effect)

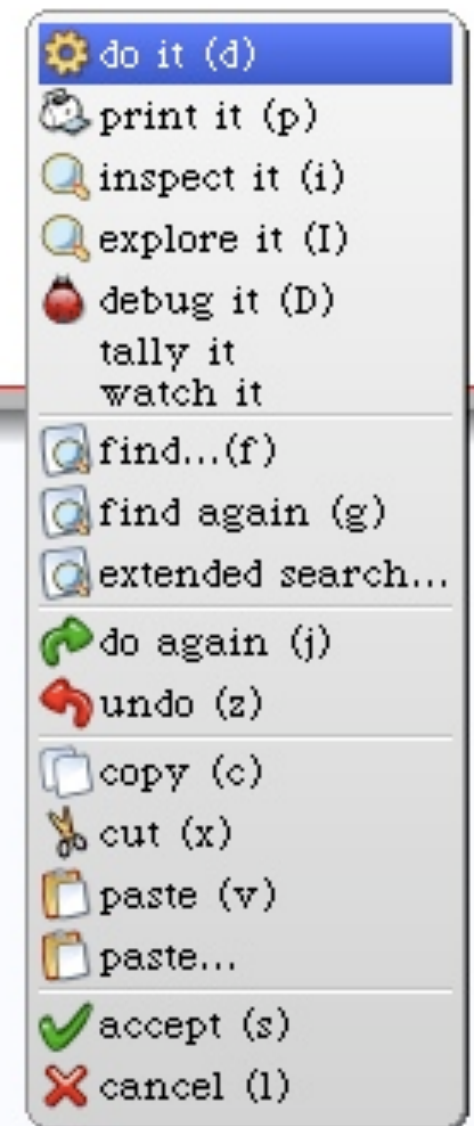
and returning an object

Browser newOnClass: Point

> a Browser

Doing and do not care of the returned result

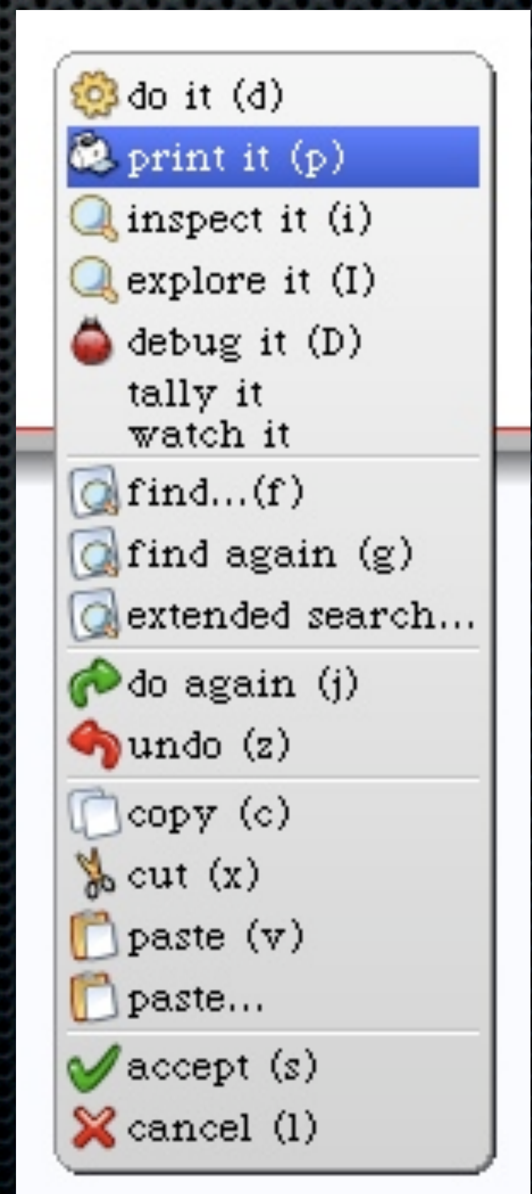
Browser newOnClass: Point



Doing and really want to see the result!

10@20 setX: 2

> 2@20



Doing vs printing (doing + print result)

Doing vs printing (doing + print result)

Roadmap

Messages messages
and messages again

Composition: from left to right!

- Yes there are only messages
  - unary
  - binary
  - keywords

Composition: from left to right!

69 class inspect

69 class superclass superclass inspect

Precedence

Unary> Binary> Keywords

Precedence

2 + 3 squared

Precedence

2 + 3 squared

> 2 + 9

Precedence

2 + 3 squared

> 2 + 9

> 11

Color gray - Color white = Color black

Color gray - Color white = Color black

> aColor = Color black

Color gray - Color white = Color black

> aColor = Color black

> true

```
2 raisedTo: 3 + 2
```

```
2 raisedTo: 3 + 2

> 2 raisedTo: 5
```

```
2 raisedTo: 3 + 2
> 2 raisedTo: 5
> 32
```

No mathematical precedence

1/3 + 2/3

No mathematical precedence

1/3 + 2/3

>7/3 /3

(Msg) > Unary> Binary> Keywords

Parenthesized takes precedence!

(0@0 extent: 100@100) bottomRight

(0@0 extent: 100@100) bottomRight

> (aPoint extent: anotherPoint) bottomRight

(0@0 extent: 100@100) bottomRight

> (aPoint extent: anotherPoint) bottomRight

> aRectangle bottomRight

```
(0@0 extent: 100@100) bottomRight

> (aPoint extent: anotherPoint) bottomRight

> aRectangle bottomRight

> 100@100
```

0@0 extent: 100@100 bottomRight

0@0 extent: 100@100 bottomRight

> Message not understood

> 100 does not understand bottomRight

No mathematical precedence

3 + 2 * 10

No mathematical precedence

3 + 2 * 10

> 5 * 10

No mathematical precedence

3 + 2 * 10

> 5 * 10

> 50

argh!

No mathematical precedence

3 + (2 * 10)

No mathematical precedence

3 + (2 * 10)

> 3 + 20

No mathematical precedence

3 + (2 * 10)

> 3 + 20

> 23

No mathematical precedence

1/3 + 2/3

> 7/3 /3

No mathematical precedence

1/3 + 2/3

> (7/3) /3

> 7/9

No mathematical precedence

(1/3) + (2/3)

No mathematical precedence

(1/3) + (2/3)

> 1

Only Messages

(Msg) > Unary > Binary > Keywords

from left to right

No mathematical precedence

Only Messages

(Msg) > Unary > Binary > Keywords

from left to right

No mathematical precedence

Roadmap

- Fun with blocks

Function definition

fct(x) = x * x + x

Function Application

fct (2) = 6

fct (20) = 420

Function definition

fct(x) = x * x + x

|fct|

fct:= **[:x |** x * x + x**]**.

Function Application

fct (2) = 6

fct (20) = 420

fct value: 2

> 6

fct value: 20

Other examples

```
[2 + 3 + 4 + 5] value

[:x | x + 3 + 4 + 5 ] value: 2

[:x :y | x + y + 4 + 5] value: 2 value: 3
```

Block

anonymous method

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

value: ...

Block

- anonymous method
- Really really cool!
- Can be passed to methods, stored in instance variables

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

Roadmap

Fun with conditional

Example

```
3 > 0
    ifTrue:['positive']
    ifFalse:['negative']
```

Example

```
3 > 0
    ifTrue:['positive']
    ifFalse:['negative']

> 'positive'
```

Yes ifTrue:ifFalse: is a message!

```
Weather isRaining
    ifTrue: [self takeMyUmbrella]
    ifFalse: [self takeMySunglasses]
```

ifTrue:ifFalse is sent to an object: a boolean!

Booleans

& | not

or: and: (lazy)

xor:

ifTrue:ifFalse:

ifFalse:ifTrue:

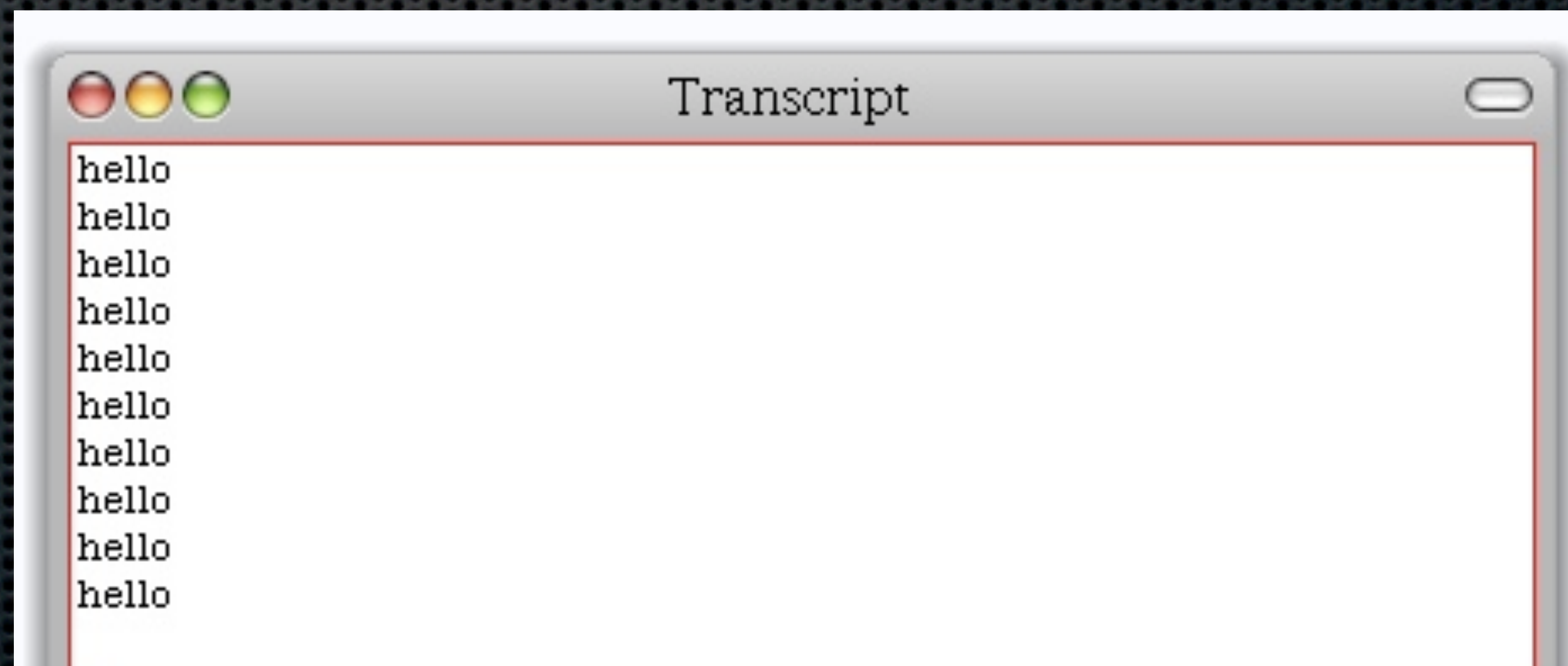
...

Yes! ifTrue:ifFalse: is a message send to a Boolean.

But optimized by the compiler :)

```
10 timesRepeat: [ Transcript show:
'hello'; cr]
```

10 timesRepeat: [Transcript show: 'hello'; cr]



```
[x<y] whileTrue: [x := x + 3]
```

aBlockTest whileTrue

aBlockTest whileFalse

aBlockTest whileTrue: *aBlockBody*

aBlockTest whileFalse: *aBlockBody*

anInteger timesRepeat: *aBlockBody*

Confused with () and [] ?

Only put [ ] when you do not the number of times something may be executed

(x isBlue**)** ifTrue: **[** x schroumph **]**

10 timesRepeat: **[** self shout **]**

Conditions are messages sent to boolean

```
(x isBlue) ifTrue: [   ]
```

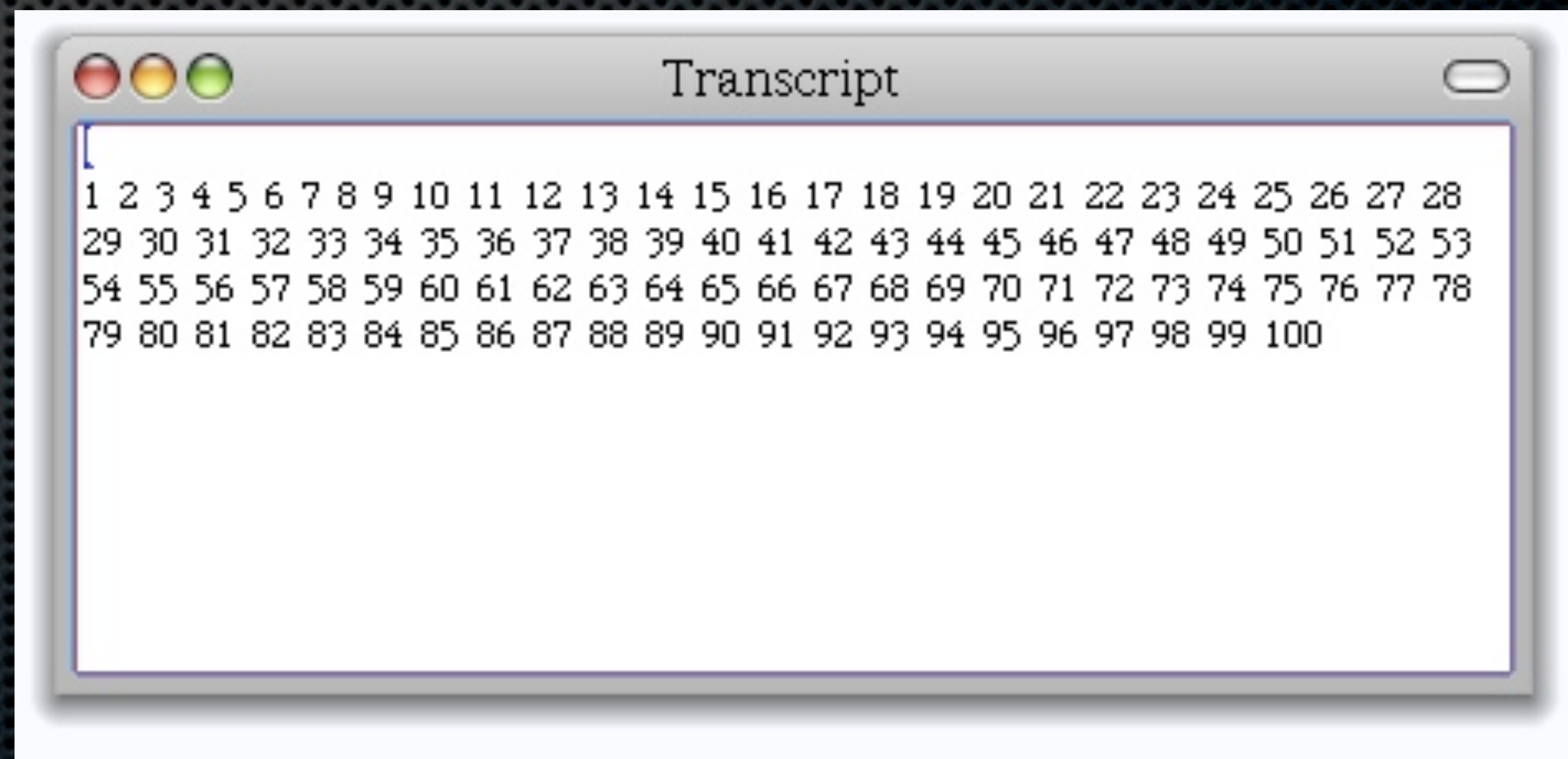
Roadmap

Fun with loops

```
1 to: 100 do:
    [ :i | Transcript show: i ; space]
```

1 **to:** 100 **do:**

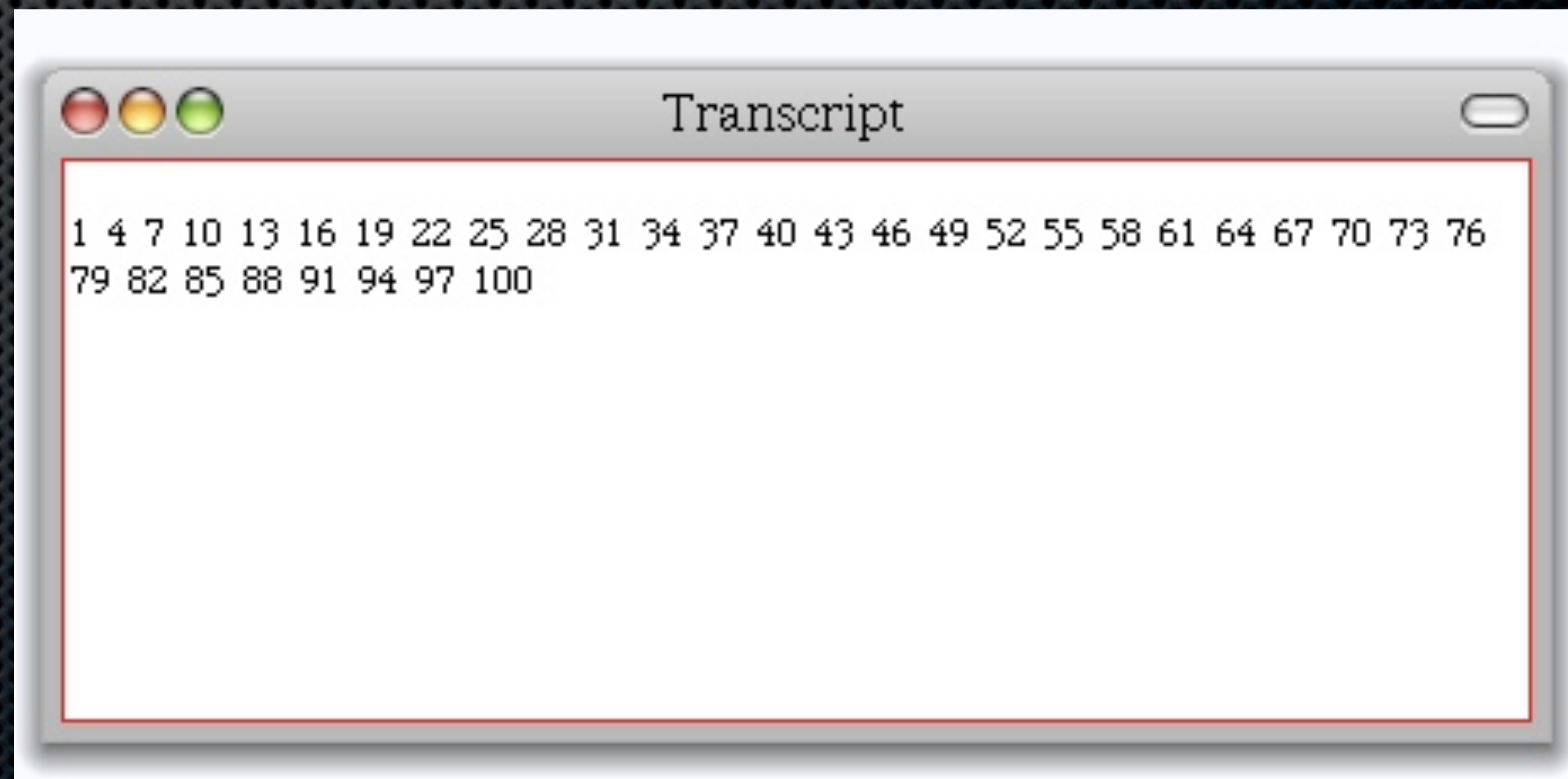
[:i | Transcript show: i ; space]



```
1 to: 100 by: 3 do:
    [ :i | Transcript show: i ; space]
```

1 **to:** 100 **by:** 3 **do:**

[:i | Transcript show: i ; space]



So yes there are real loops in Smalltalk!

to:do:

to:by:do:

are just messages send to integers

So yes there are real loops in Smalltalk!

to:do:

to:by:do:

are just messages send to integers

Roadmap

- Fun with iterators

```
ArrayList<String> strings
            = new ArrayList<String>();
for(Person person: persons)
        strings.add(person.name());
```

```
strings :=
persons collect [:person | person name].
```

#(2 -3 4 -35 4) **collect:** [:each| each abs]

```
#(2 -3 4 -35 4) collect: [ :each| each abs]

> #(2 3 4 35 4)
```

#(15 10 19 68) **collect:** [:i | i odd]

#(15 10 19 68) **collect:** [:i | i odd]

> #(true false true false)

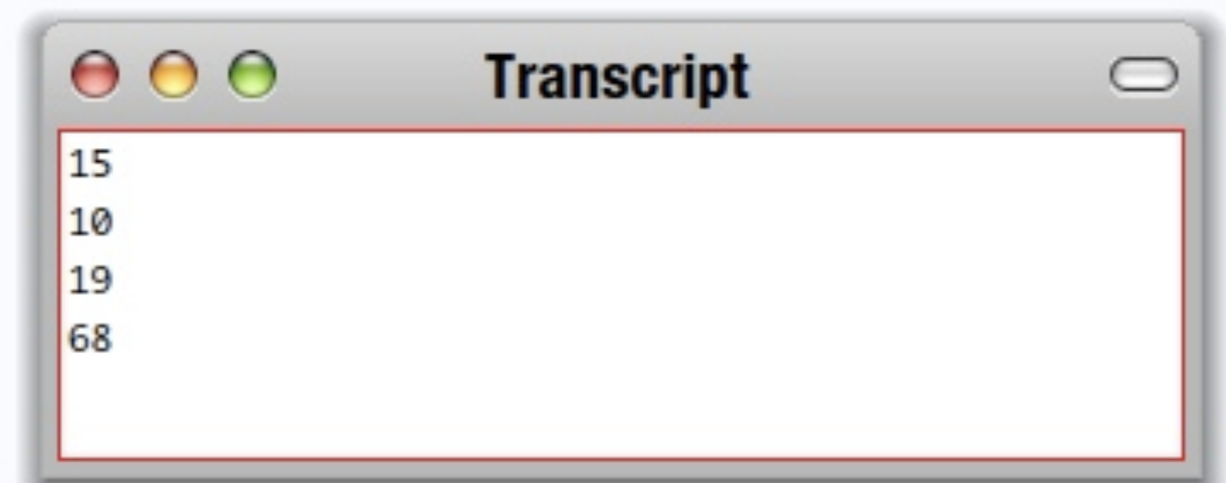
#(15 10 19 68) **collect:** [:i | i odd]

We can also do it that way!

```
|result|
aCol :=  #( 2 -3 4 -35 4).
result := aCol species new: aCol size.
1 to: aCollection size do:
        [ :each | result at: each put: (aCol at: each) odd].
result
```

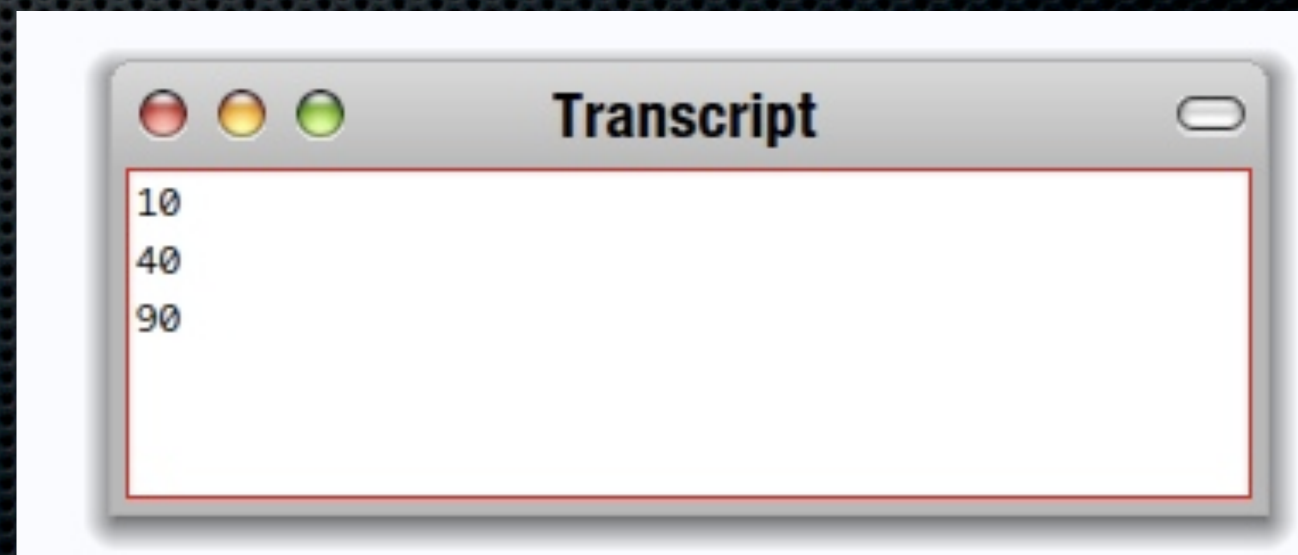
```
#(15 10 19 68) do:
    [:i | Transcript show: i ; cr ]
```

```
#(15 10 19 68) do:
    [:i | Transcript show: i ; cr ]
```



```
#(1 2 3)
    with: #(10 20 30)
    do: [:x :y| Transcript show: (y ** x) ; cr ]
```

```
#(1 2 3)
    with: #(10 20 30)
    do: [:x :y| Transcript show: (y ** x) ; cr ]
```



How do: is implemented?

How do: is implemented?

SequenceableCollection>>do: aBlock
"Evaluate aBlock with each of the receiver's elements as the argument."

1 **to:** self size **do:** [:i | aBlock value: (self **at:** i)]

```
#(15 10 19 68) select: [:i|i odd]

#(15 10 19 68) reject: [:i|i odd]

#(12 10 19 68 21) detect: [:i|i odd]

#(12 10 12 68) detect: [:i|i odd] ifNone:[1]
```

```
#(15 10 19 68) select: [:i|i odd]

> #(15 19)

#(15 10 19 68) reject: [:i|i odd]

#(12 10 19 68 21) detect: [:i|i odd]

#(12 10 12 68) detect: [:i|i odd] ifNone:[1]
```

```
#(15 10 19 68) select: [:i|i odd]

> #(15 19)

#(15 10 19 68) reject: [:i|i odd]

> #(10 68)

#(12 10 19 68 21) detect: [:i|i odd]



#(12 10 12 68) detect: [:i|i odd] ifNone:[1]
```

```
#(15 10 19 68) select: [:i|i odd]

> #(15 19)

#(15 10 19 68) reject: [:i|i odd]

> #(10 68)

#(12 10 19 68 21) detect: [:i|i odd]

> 19

#(12 10 12 68) detect: [:i|i odd] ifNone:[1]
```

```
#(15 10 19 68) select: [:i|i odd]

> #(15 19)

#(15 10 19 68) reject: [:i|i odd]

> #(10 68)

#(12 10 19 68 21) detect: [:i|i odd]

> 19

#(12 10 12 68) detect: [:i|i odd] ifNone:[1]

> 1
```

- Iterators are your best friends
  - compact
  - nice abstraction
  - Just messages sent to collections

Iterators are your best friends

- compact
- nice abstraction
- Just messages sent to collections

How do you define the method that does that?

#() -> ‘’

#(a) ->’a’

#(a b c) -> ‘a, b, c’

```
#(a b c)
    do: [:each | Transcript show: each printString]
    separatedBy: [Transcript show: ‘,’]
```

```
#(a b c)
    do: [:each | Transcript show: each printString]
    separatedBy: [Transcript show: ‘,’]
```

Roadmap

- Cascading

Messages Sequence

```
message1 .
message2 .
message3
```

. is a separator, not a terminator

```
| macNode pcNode node1 printerNode |
macNode := Workstation withName: #mac.
```

Multiple messages to an objects ;

To send multiple messages to the same object

```
Transcript show: 1 printString.
Transcript cr
```

is equivalent to:

WHAT ARE YOU **DOING**?! YOU'RE GOING TO BE LATE FOR SCHOOL! HURRY UP AND PUT YOUR CLOTHES ON RIGHT!

IT'S SAD HOW SOME PEOPLE CAN'T HANDLE A LITTLE VARIETY.
WATTERSON

Pharo

http://www.pharo.org