

Tools shaped our mind...

<http://stephane.ducasse.free.fr>

<http://www.pharo.org>



Tools

- Shape our mind...
- Get moldable tools so that **you CAN adapt them to you and your process** and not the inverse
- Build fast **your own tools**

Pharo has amazing
moldable tools

How to find information?

- Libraries are large
- You know what you want
- You do not know how to express it

Ask Finder example-based queries

- Provide objects and results
- Get the messages that match

11 ??? 2 should give 5

x - □ **Finder**

11.2.5 Regexp Examples

▼ 11 // 2 --> 5
Collection
Duration
*Integer
LargeInteger
*Number
Point
*SmallInteger

► 11 quo: 2 --> 5

Browse Senders Implementors Versions Inheritance Hierarchy

Use an example to find a method in the system.

'a'. 'b'. 'ab' concatenation	will find the message #, for strings
2. -2	will find the message #negated
3. 6	will find the message #factorial

111 ??? 2 should give 5.5

x - □ Finder
11.2.5.5 Search Regexp Examples Packages... All Packages

- FileSystem class
- FloatArray
- *Fraction
- IceNode
- Integer
- LargeInteger
- *Number
- Path
- Path class

Browse Senders Implementors Versions Inheritance Hierarchy

```
/ aNumber
    "Answer the result of dividing the receiver by aNumber."
    aNumber isFraction
        ifTrue: [^self * aNumber reciprocal].
    ^ aNumber adaptToFraction: self andSend: #/
```

What are the messages send to \$0 that return true

x - □ Finder

\$0 . true Search Regexp Examples Packages... All Packages

- \$0 isAlphaNumeric --> true
- \$0 isCharacter --> true
- \$0 isCompletionCharacter --> true
- \$0 isDecimalDigit --> true
- ▼ \$0 isDigit --> true
 - Character
 - \$0 isLiteral --> true
 - \$0 isOctetCharacter --> true
 - \$0 isSafeForHTTP --> true
 - \$0 shouldBePrintedAsLiteral --> true
 - \$0 tokenish --> true

Browse Senders Implementors Versions Inheritance Hierarchy

isDigit

"Return whether the receiver is a digit."

"\$1 isDigit >>> true"

"\$0 isDigit >>> true"

^ self characterSet isDigit: self

Customized object
interaction/presentations

Inspecting Live a 3D object

Playground

Page a RWView

Raw Live Meta

an Array [4 items] ('2000-01-01' 'Malawi' 'France' '400.0')

Items Raw Meta

Index	Item
1	'2000-01-01'
2	'Malawi'
3	'France'
4	'400.0'

data := TestData new data.

cube := MatrixCube new initWithData: data.

cube view

enter search query (example: "each = 5")

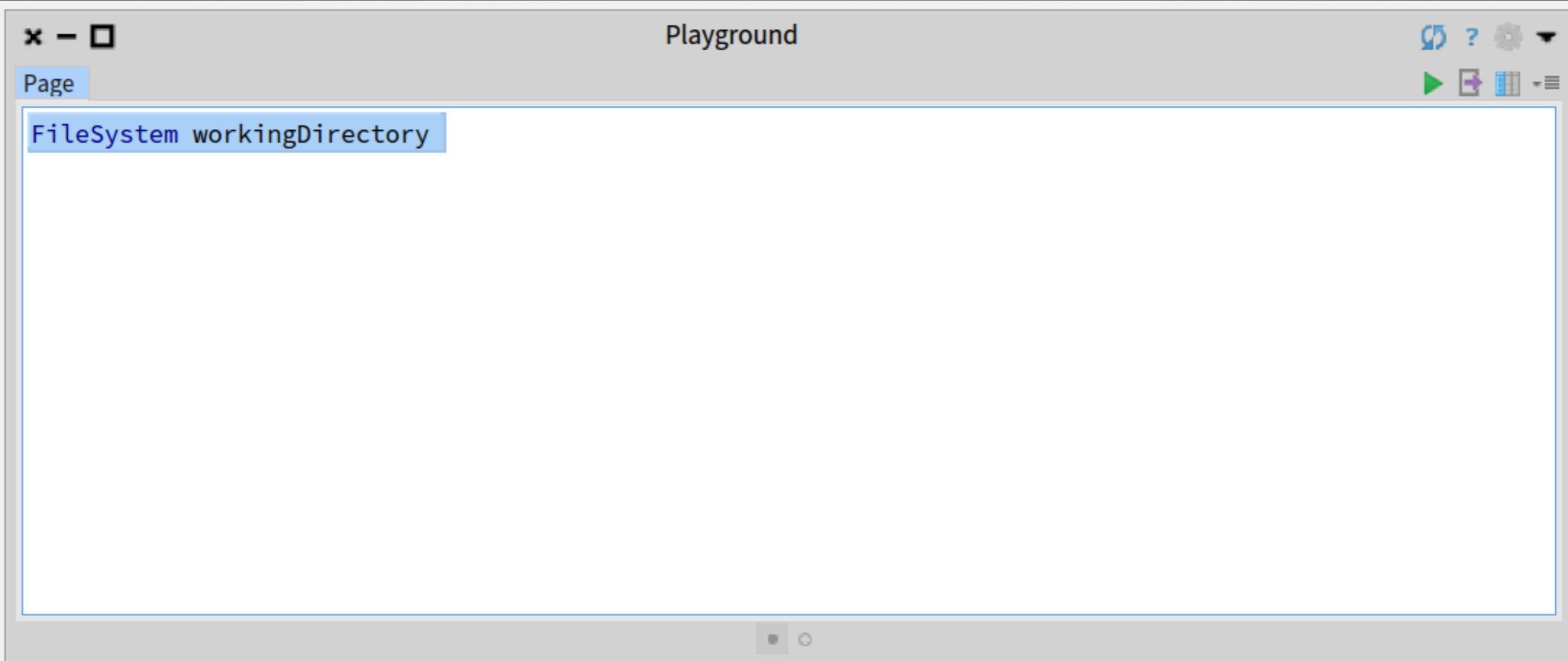
The screenshot shows a software interface titled 'Playground'. On the left, there is a code editor with the following code:

```
data := TestData new data.  
  
cube := MatrixCube new initWithData: data.  
cube view
```

Below the code editor is a 3D visualization of a matrix cube, composed of numerous small gray cubes arranged in a grid-like structure. To the right of the visualization is a table titled 'an Array [4 items] ('2000-01-01' 'Malawi' 'France' '400.0')'. The table has four rows, each representing an item in the array. The first three items correspond to the dimensions of the matrix cube, while the fourth item corresponds to its value. At the bottom of the interface, there is a search bar with the placeholder text 'enter search query (example: "each = 5")'.

The views of a file reference

Looking at a file reference



Oh! a file browser in my inspector!

Playground

Page

a FileReference (/Users/ducasse/Documents/Pharo/images/F...)

FileSystem workingDirectory

Name	Size
..	0 B
pharo-local	0 B
logo.png	25.82 kB
pharo.version	3 B
ReadMe.txt	63 B
meta-inf.ston	1.17 kB
P8-MasterClass.image	70.22 MB
P8-MasterClass.changes	1.16 kB
Archive.zip	27.24 kB
Pharo8.0-32bit-0932da8.sources	37.94 MB

But I have a file reference: a dull object

The screenshot shows a Pharo playground interface. The title bar says "Playground". The top menu bar includes "Page" (selected), "File", "Edit", "View", "Help", and a search icon. A toolbar below the menu has icons for "Run", "Stop", "Reset", and "Search". The workspace on the left contains the code: "FileSystem workingDirectory". The right side displays a "FileReference" object with its details:

Variable	Value
self	/Users/ducasse/Documents/Pharo/images/I
filesystem	a FileSystem
path	Path / 'Users' / 'ducasse' / 'Documents' / 'Ph

Below the table, the code continues with:

```
"File @  
/Users/ducasse/Documents/Pharo/images/P8-MasterCl  
ass"  
self parent
```

The word "parent" is highlighted with a yellow background.

Quite boring object

Playground

Page a FileReference (/Users/ducasse/Documents/Pharo/images/F...)

FileSystem workingDirectory

Variable	Value
self	/Users/ducasse/Documents/Pharo/images/I
filesystem	a FileSystem
path	Path / 'Users' / 'ducasse' / 'Documents' / 'Ph

```
"File @  
/Users/ducasse/Documents/Pharo/images/P8-MasterCl  
ass"  
self fullName '/Users/ducasse/Documents/Pharo/images/P8-MasterClass'
```

We can see the png ;)

x - □

Playground

a FileReference (/Users/ducasse/Documents/Pharo/images/P8-M...)

Items Raw Meta

Name	Size
..	0 B
pharo-local	0 B
logo.png	25.82 kB
pharo.version	3 B
ReadMe.txt	63 B
meta-inf.ston	1.17 kB
P8-MasterClass.image	70.22 MB
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Archive.zip	27.24 kB
Pharo8.0-32bit-0932da8.sources	37.94 MB

a FileReference (/Users/ducasse/Documents/Pharo/images/P8-M...)

Picture Contents Raw Meta

The Pharo logo, featuring the word "Pharo" in a large blue sans-serif font with a white outline. A circular icon containing a lighthouse is positioned to the right of the letter "o".

Looking inside that PNG file

Playground

a FileReference (/Users/ducasse/Documents/Pharo/images/P8-M...)

a FileReference (/Users/ducasse/Documents/Pharo/images/P8-M...)

Items Raw Meta

Picture Contents Raw Meta

Name	Size
..	0 B
pharo-local	0 B
logo.png	25.82 kB
pharo.version	3 B
ReadMe.txt	63 B
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P8-MasterClass.image	70.22 MB
P8-MasterClass.changes	1.16 kB
Archive.zip	27.24 kB
Pharo8.0-32bit-0932da8.sources	37.94 MB

1 00000000 89 50 4E 47 0D 0A 1A 0A 00 00 00
0D 49 48 44 52 |.PNG.....IHDR|
2 00000010 00 00 01 77 00 00 00 90 08 06 00
00 00 F3 F6 2B | ...w.....+|
3 00000020 70 00 00 0A D1 69 43 43 50 49 43
43 20 50 72 6F |p....iCCPICC Pro|
4 00000030 66 69 6C 65 00 00 48 89 95 97 07
54 53 69 16 C7 |file..H....TSi..|
5 00000040 BF F7 D2 43 42 4B 08 45 4A E8 4D
90 5E A5 84 1E |...CBK.EJ.M.^...|
6 00000050 40 41 3A D8 08 49 48 42 09 21 05
15 3B 32 38 02 |@A:..IHB.!...;28.|
7 00000060 23 8A 8A 08 96 01 1D 8A 28 38 16

But still a file reference!

Playground

a FileReference (/Users/ducasse/Documents/Pharo/images/P8-M...)

Items Raw Meta

Name	Size
..	0 B
pharo-local	0 B
logo.png	25.82 kB
pharo.version	3 B
ReadMe.txt	63 B
meta-inf.ston	1.17 kB
P8-MasterClass.image	70.22 MB
P8-MasterClass.changes	1.16 kB
Archive.zip	27.24 kB
Pharo8.0-32bit-0932da8.sources	37.94 MB

Picture Contents Raw Meta

Variable	Value
self	/Users/ducasse/Documents/Pharo/images/I
filesystem	a FileSystem
path	Path / 'Users' / 'ducasse' / 'Documents' / 'Ph

```
"File @  
/Users/ducasse/Documents/Pharo/images/P8-MasterCl  
ass/logo.png"  
self fullName '/Users/ducasse/Documents/Pharo/images/P8-MasterClass/logo.png'
```

See! an archive ‘.zip’

Playground

a FileReference (/Users/ducasse/Documents/Pharo/images/P8-M...)

Items Raw Meta

Name	Size
..	0 B
pharo-local	0 B
logo.png	25.82 kB
pharo.version	3 B
ReadMe.txt	63 B
meta-inf.ston	1.17 kB
P8-MasterClass.image	70.22 MB
P8-MasterClass.changes	1.16 kB
Archive.zip	27.24 kB
Pharo8.0-32bit-0932da8.sources	37.94 MB

a FileReference (/Users/ducasse/Documents/Pharo/images/F...)

Items Contents Raw Meta

1	00000000 50 4B 03 04 14 00 08 00 08 00 E1 AA 16 51 00 00 PK.....Q...
2	00000010 00 00 00 00 00 00 00 00 00 00 08 00 10 00 6C 6F lo
3	00000020 67 6F 2E 70 6E 67 55 58 0C 00 A4 70 41 5F 96 70 go.pngUX...pA_.p
4	00000030 41 5F F7 01 14 00 6C B7 63 90 68 41 B3 25 DA B6 A....l.c.hA.%..
5	00000040 6D DB B6 6D BB FB B4 6D DB B6 79 DA B6 6D DB B6 m....m....y....m...
6	00000050 6D 5B EF 7C F7 DE 99 79 F1 DE D4 8F 8A 55 99 2B m[.y.....U.+
7	00000060 57 46 66 C4 DE 55 19 A1 20 27 0E

Kind of clear...

Playground

a FileReference (/Users/ducasse/Documents/Pharo/images/P8-M...)

Items Raw Meta

Name	Size
..	0 B
pharo-local	0 B
logo.png	25.82 kB
pharo.version	3 B
ReadMe.txt	63 B
meta-inf.ston	1.17 kB
P8-MasterClass.image	70.22 MB
P8-MasterClass.changes	1.16 kB
Archive.zip	27.24 kB
Pharo8.0-32bit-0932da8.sources	37.94 MB

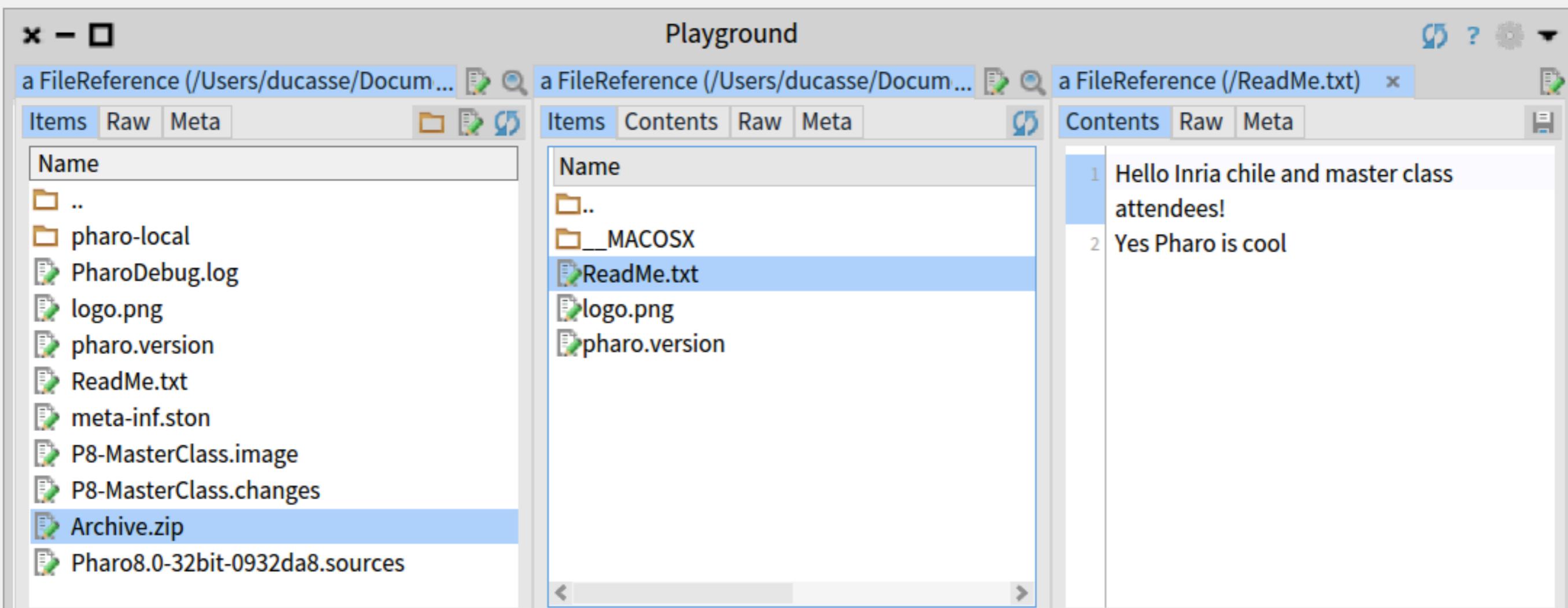
a FileReference (/Users/ducasse/Documents/Pharo/images/F...)

Items Contents Raw Meta

Name	Size
..	0 B
__MACOSX	0 B
ReadMe.txt	0 B
logo.png	0 B
pharo.version	0 B

An object can expose multiple interactive views!

- You can use the best view for your task!
- You can add views to your domain objects



**It is supra cool but it is not
magic**

Implementing a pane!

The screenshot shows the GT-InspectorExtensions-Core interface with the following details:

- Title Bar:** AbstractFileReference>>gtInspectorPngIn:
- Left Panel (Public Methods):** Shows various file system-related classes and methods like AbstractFileReference, FileLocator, FileReference, FileSystem, etc.
- Middle Panel (gtInspectorPngIn: Implementation):**
 - Method signature: gtInspectorPngIn: composite
 - Implementation:

```
<gtInspectorPresentationOrder: 0>
composite morph
    title: 'Picture';
    display: [ self binaryReadStreamDo: [ :stream | PNGReadWriter formFromStream: stream ] ];
    when: [ self isFile and:
        [ self mimeTypes notNil and:
            [ self mimeTypes first matches: ZnMimeType imagePng ] ] ]
```
- Right Panel (gtInspectorPngIn: Implementations):** Shows other implementations of the gtInspectorPngIn: method for various classes like gtInspectorActionMaterializeFn, gtInspectorContentsIn:, etc.
- Bottom Navigation:** Includes tabs for Comment, AbstractFileReference, *gtInspectorPngIn:, Inst. side method, and buttons for Comment, Search, and Help.
- Page Footer:** 8/8 [9] and GT-InspectorExtensions-Core extension F +

Ok files are boring...
What about *inside*
the system?



A class is an object we can inspect!

The screenshot shows a debugger interface with a title bar "Playground". Below it, a tab bar has "Page" selected. A search bar contains the text "a Point class (Point)". A toolbar with various icons is visible. The main area displays a table titled "Variable" with columns "Variable" and "Value". The table lists several variables:

Variable	Value
self	Point
superclass	Object
methodDict	a MethodDictionary [103 items] (size 103)
format	65538
layout	a FixedLayout
organization	a ClassOrganization
subclasses	nil
name	#Point
classPool	a Dictionary [0 items] ()
"Point"	
self	

“A class has a *method dictionary*” they said... let us verify

Playground

a Point class (Point)

Raw Defir... Met... All R... All Ref Com... Inst... Insta... Meta

Variable	Value
self	Point
superclass	Object
methodDict	a MethodDictionary [103 items] (size 103)
format	65538
layout	a FixedLayout
organization	a ClassOrganization
subclasses	nil
name	#Point
classPool	a Dictionary [0 items] ()

"Point"
self

a MethodDictionary [103 items] (size 103)

Items Keys Raw Meta

Key	Value
#reflectedAbout:	Point>>#reflectedAbout:
#rotateBy:centerAt:	Point>>#rotateBy:centerAt:
#adaptToNumber:andSend:	Point>>#adaptToNumber:andSend:
#squaredDistanceTo:	Point>>#squaredDistanceTo:
#adaptToCollection:andSend:	Point>>#adaptToCollection:andSend:
#theta	Point>>#theta
#transposed	Point>>#transposed
#-	Point>>#-
#fourDirections	Point>>#fourDirections
#crossProduct:	Point>>#crossProduct:
#scaleFrom:to:	Point>>#scaleFrom:to:
#veryDeepCopyWith:	Point>>#veryDeepCopyWith:

Dissecting one method object

x - □ Inspector on a CompiledMethod (Point>>#degrees) ⚙ ? ▾

a CompiledMethod (Point>>#degrees)

Raw Bytecode Source Ir AST Header Meta

Variable	Value
{ } self	Point>>#degrees
► Σ literal1	90.0
► Σ literal2	270.0
► ¶ literal3	#asFloat
► ¶ literal4	#arcTan
► ¶ literal5	#radiansToDegrees
► Σ literal6	360.0
► Σ literal7	180.0
► ¶ literal8	#ifTrue:#ifFalse:
► Σ bc 89	0

"Point>>#degrees"
self

I do not want to be a compiler!

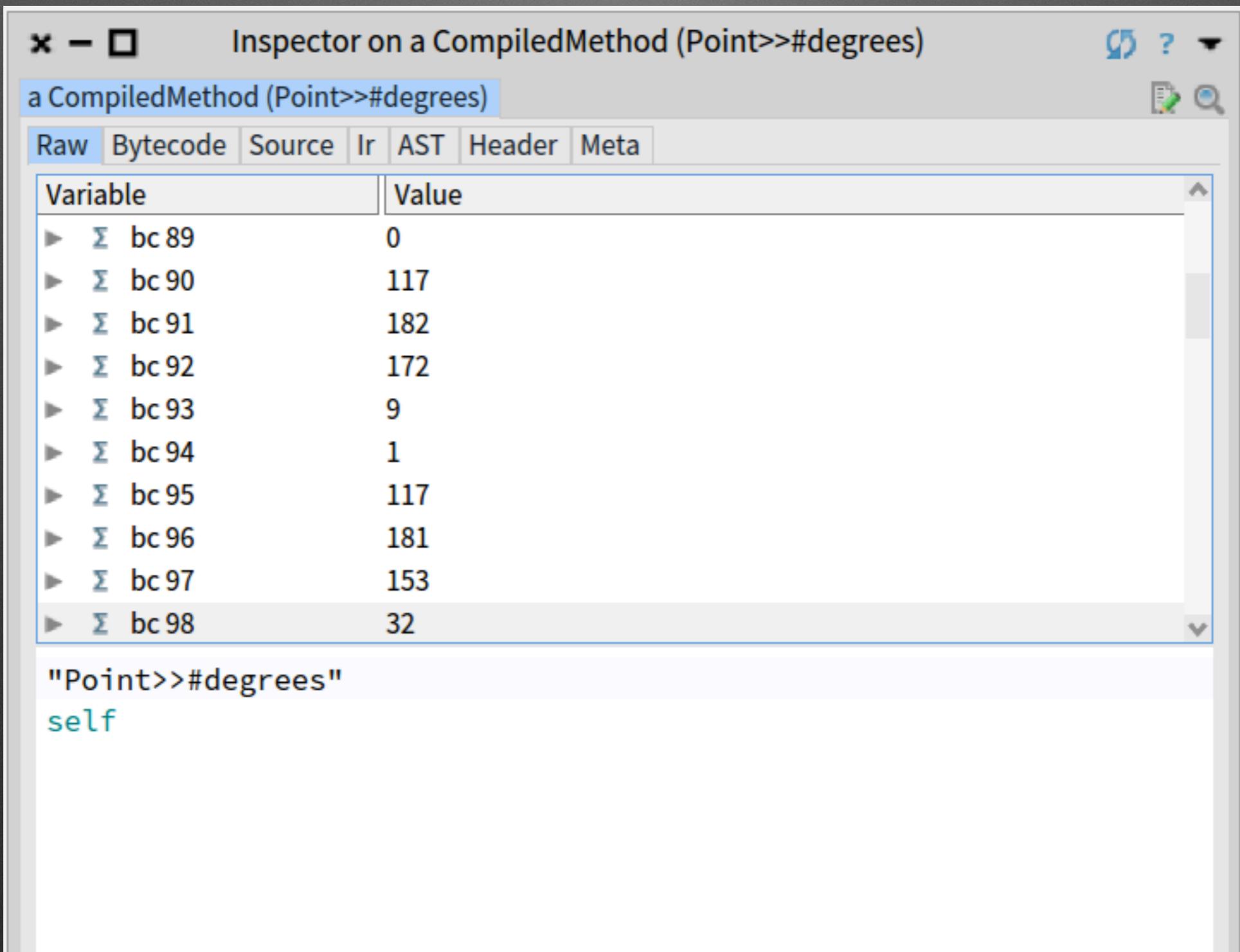
x - □ Inspector on a CompiledMethod (Point>>#degrees) ⚙ ? ▾

a CompiledMethod (Point>>#degrees)

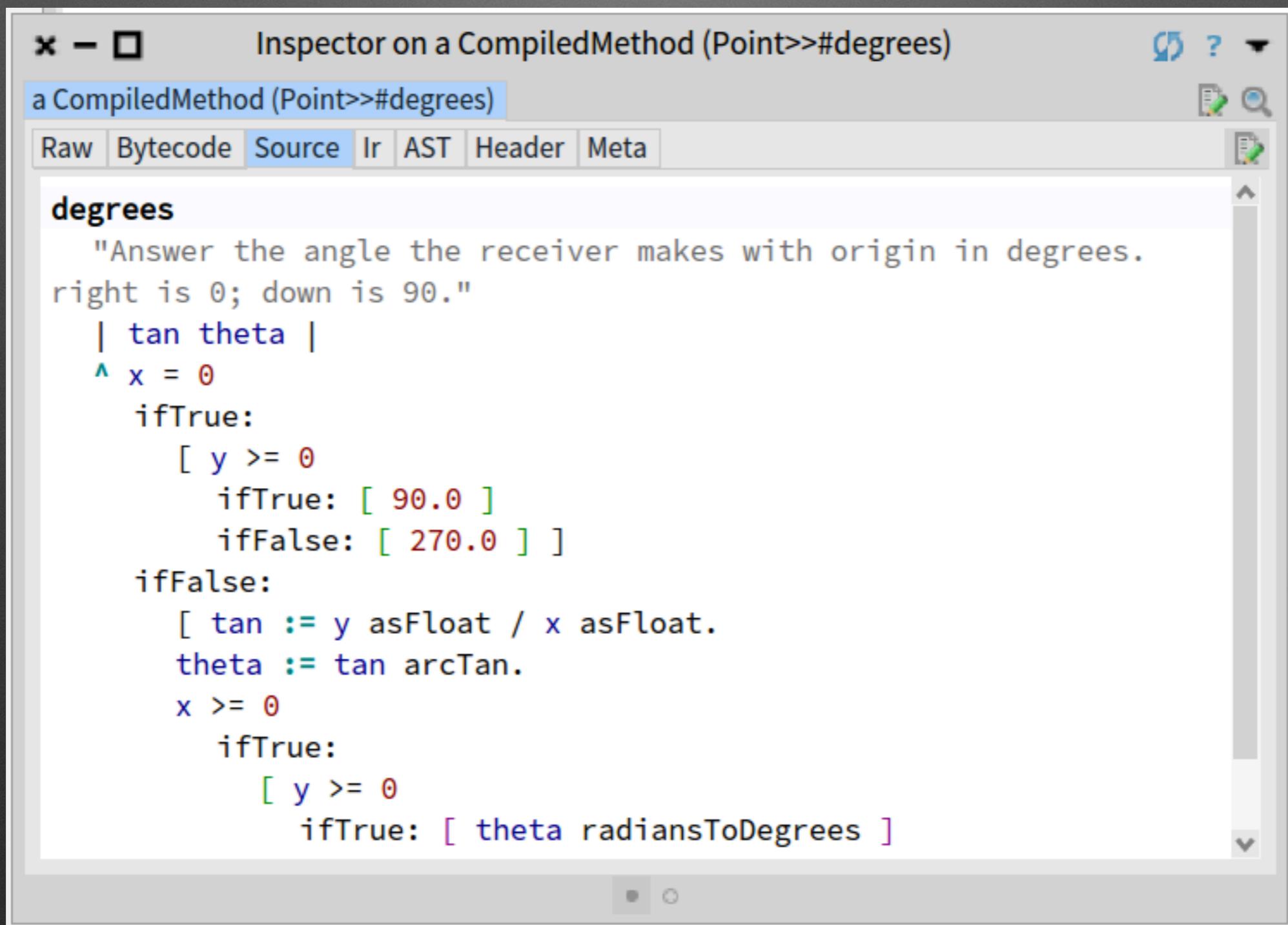
Raw Bytecode Source Ir AST Header Meta

Variable	Value
► Σ bc 89	0
► Σ bc 90	117
► Σ bc 91	182
► Σ bc 92	172
► Σ bc 93	9
► Σ bc 94	1
► Σ bc 95	117
► Σ bc 96	181
► Σ bc 97	153
► Σ bc 98	32

"Point>>#degrees"
self

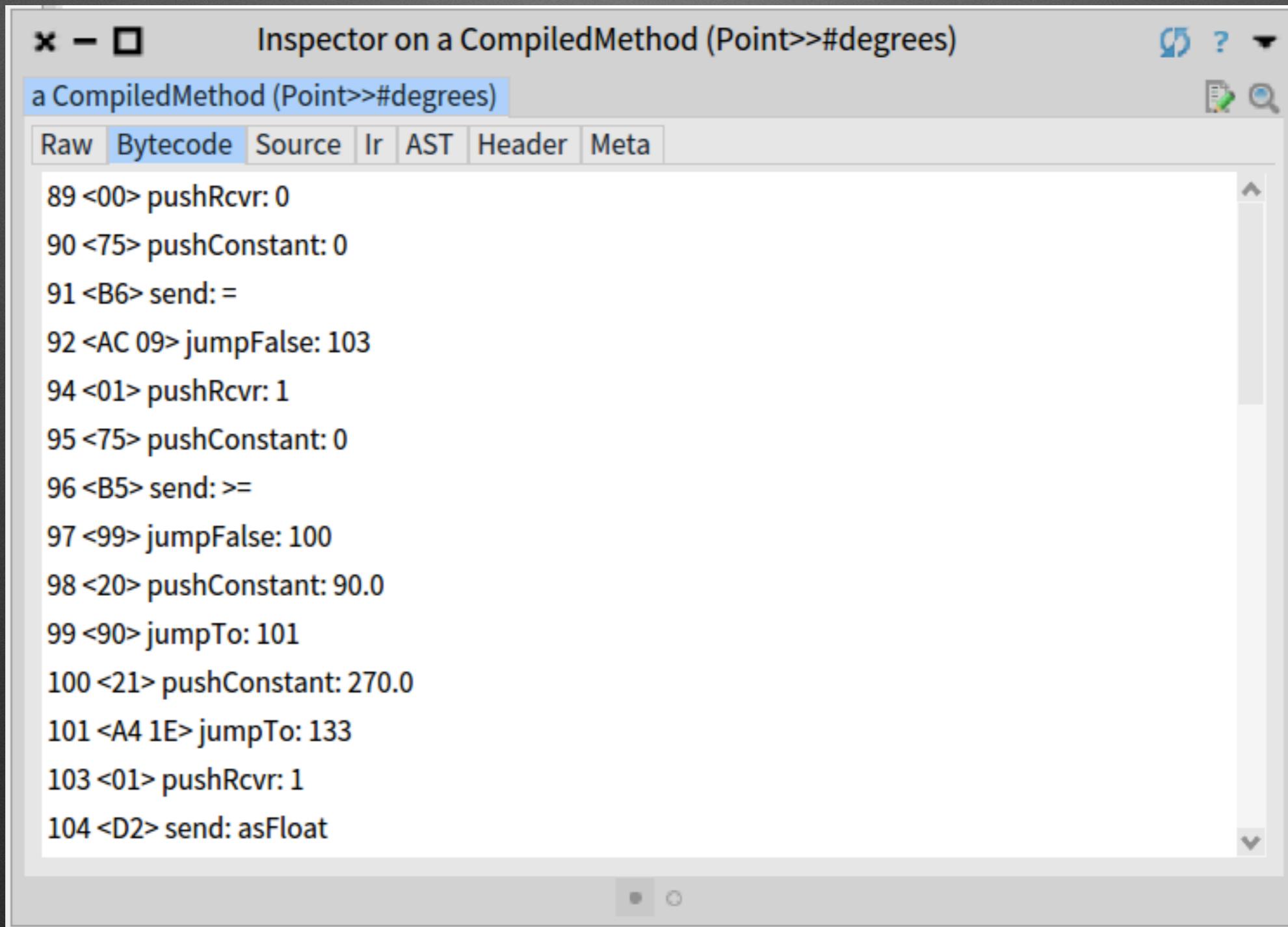


It looks like a method



degrees
"Answer the angle the receiver makes with origin in degrees.
right is 0; down is 90."
| tan theta |
^ x = 0
ifTrue:
[y >= 0
ifTrue: [90.0]
ifFalse: [270.0]]
ifFalse:
[tan := y asFloat / x asFloat.
theta := tan arcTan.
x >= 0
ifTrue:
[y >= 0
ifTrue: [theta radiansToDegrees]

Numbers are not that obscure



The screenshot shows a window titled "Inspector on a CompiledMethod (Point>>#degrees)". The title bar includes standard icons for close, minimize, maximize, and help. Below the title is a toolbar with icons for file operations and search. The main area is a scrollable pane containing a list of bytecode instructions. The tabs at the top of the pane are Raw, Bytecode (which is selected), Source, Ir, AST, Header, and Meta. The list of instructions is as follows:

- 89 <00> pushRcvr: 0
- 90 <75> pushConstant: 0
- 91 <B6> send: =
- 92 <AC 09> jumpFalse: 103
- 94 <01> pushRcvr: 1
- 95 <75> pushConstant: 0
- 96 <B5> send: >=
- 97 <99> jumpFalse: 100
- 98 <20> pushConstant: 90.0
- 99 <90> jumpTo: 101
- 100 <21> pushConstant: 270.0
- 101 <A4 1E> jumpTo: 133
- 103 <01> pushRcvr: 1
- 104 <D2> send: asFloat

And mapping them to the good abstraction helps

Inspector on a CompiledMethod (Point>>#degrees)

a CompiledMethod (Point>>#degrees)

Raw Bytecode Source Ir AST Header Meta

RBMethodNode(degrees "Answer the angle the receiver makes with")

- RBSequenceNode(| tan theta | ^ x=0 ifTrue: [y >= 0 ifTrue:]
 - RBTemporaryNode(tan)
 - RBTemporaryNode(theta)
- RBReturnNode(^ x=0 ifTrue: [y >= 0 ifTrue: [90.0]]
 - RBMessagNode(x = 0 ifTrue: [y >= 0 ifTrue: [90.0]]
 - RBMessagNode(x = 0)
 - RBIstanceVariableNode(x)
 - RBLiteralValueNode(0)
 - RBBBlockNode([y >= 0 ifTrue: [90.0] iffFalse: [270.0]])
 - RBSequenceNode(y >= 0 ifTrue: [90.0] iffFalse: [270.0])
 - RBMessagNode(y >= 0 ifTrue: [90.0] iffFalse: [270.0])
 - RBMessagNode(y >= 0)
 - RBBBlockNode([90.0])
 - RBBBlockNode([270.0])

a RBMessageNode (RBMessageNode(y >= 0))

Raw Tree Scopes Source cc... AST Dump Meta

degrees

"Answer the angle the receiver makes with origin in degrees. right is 0; down is 90."
| tan theta |
^ x = 0
ifTrue:
[y >= 0
ifTrue: [90.0]
iffFalse: [270.0]]
iffFalse:
[tan := y asFloat / x asFloat.
theta := tan arcTan.
x >= 0
ifTrue:
[y >= 0
ifTrue: [theta radiansToDegrees]
iffFalse: [360.0 + theta
radiansToDegrees]]

Yes pushRcvr: 1 means the second field!

Inspector on a CompiledMethod (Point>>#degrees)

a CompiledMethod (Point>>#degrees)

Raw Bytecode Source Ir AST Header Meta

```
89 <00> pushRcvr: 0
90 <75> pushConstant: 0
91 <B6> send:=
92 <AC 09> jumpFalse: 103
94 <01> pushRcvr: 1
95 <75> pushConstant: 0
96 <B5> send:>=
97 <99> jumpFalse: 100
98 <20> pushConstant: 90.0
99 <90> jumpTo: 101
100 <21> pushConstant: 270.0
101 <A4 1E> jumpTo: 133
103 <01> pushRcvr: 1
104 <D2> send: asFloat
105 <00> pushRcvr: 0
106 <D2> send: asFloat
```

a SymbolicBytecode (94 <01> pushRcvr: 1) ×

Raw Source SourceNode Meta

```
origin in degrees. right is 0; down is 90. "
| tan theta |
^ x = 0
ifTrue:
[y >= 0
ifTrue: [ 90.0 ]
ifFalse: [ 270.0 ] ]
ifFalse:
[tan := y asFloat / x asFloat.
theta := tan arcTan.
x >= 0
ifTrue:
[y >= 0
ifTrue: [ theta radiansToDegrees ]
ifFalse: [ 360.0 + theta
radiansToDegrees ] ]
ifFalse: [ 180.0 + theta
radiansToDegrees ] ]]
```

Pharo Pro devs

- Get **productivity boost**
- Xtreme TDD
 - write test,
 - test fails and
 - **code in debugger**

**Hot update on the fly
customizable debugger**

Halt

Bytecode

Stack

▶ Proceed ⏪ Restart ⏴ Into ⏵ Over ⏴ Through ⏴

PDFCellElement	getSubElementsWith:styleSheet:
PDFCellElement(PDFComposite)	generateCodeSegmentsCollectionWi
PDFCellElement(PDFComposite)	generateCodeSegmentWith:styleShe
PDFDataTableElement(PDFComposite)	generateCodeSegmentsCollectionWi [:aSubElement aSubElement generateCodeSe
Array(SequenceableCollection)	collect:

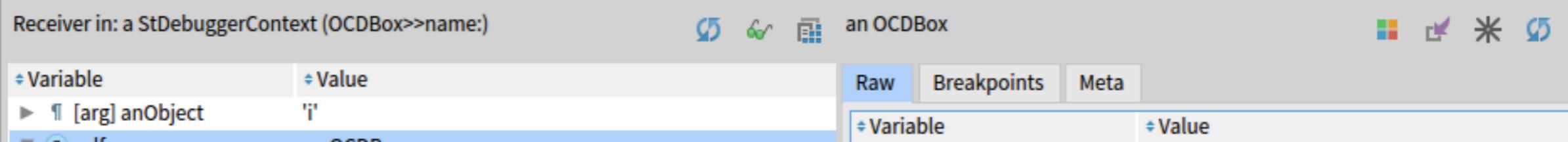
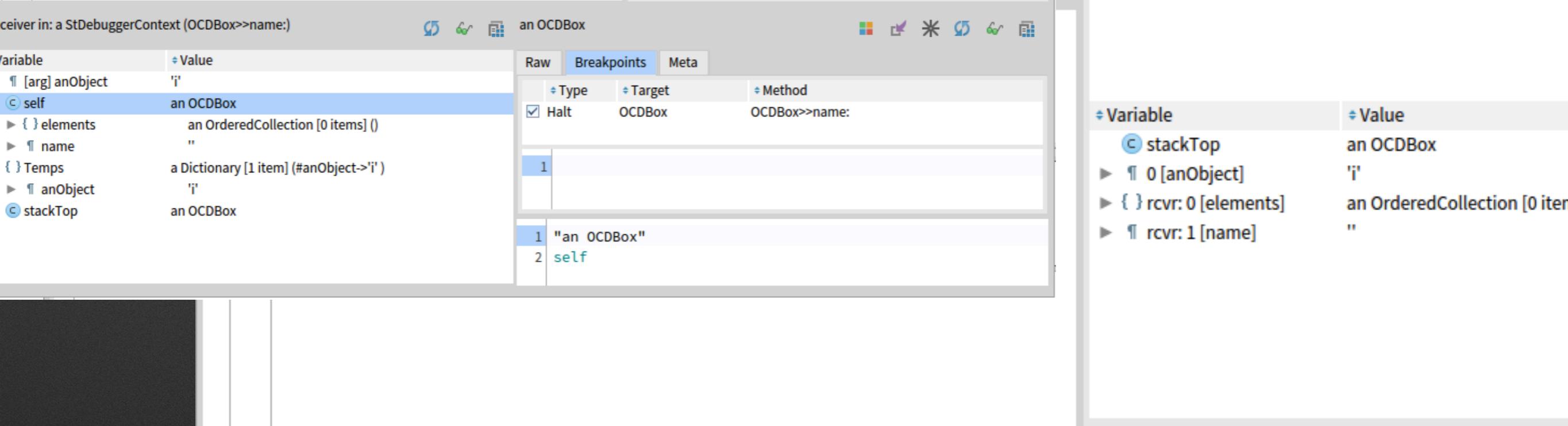
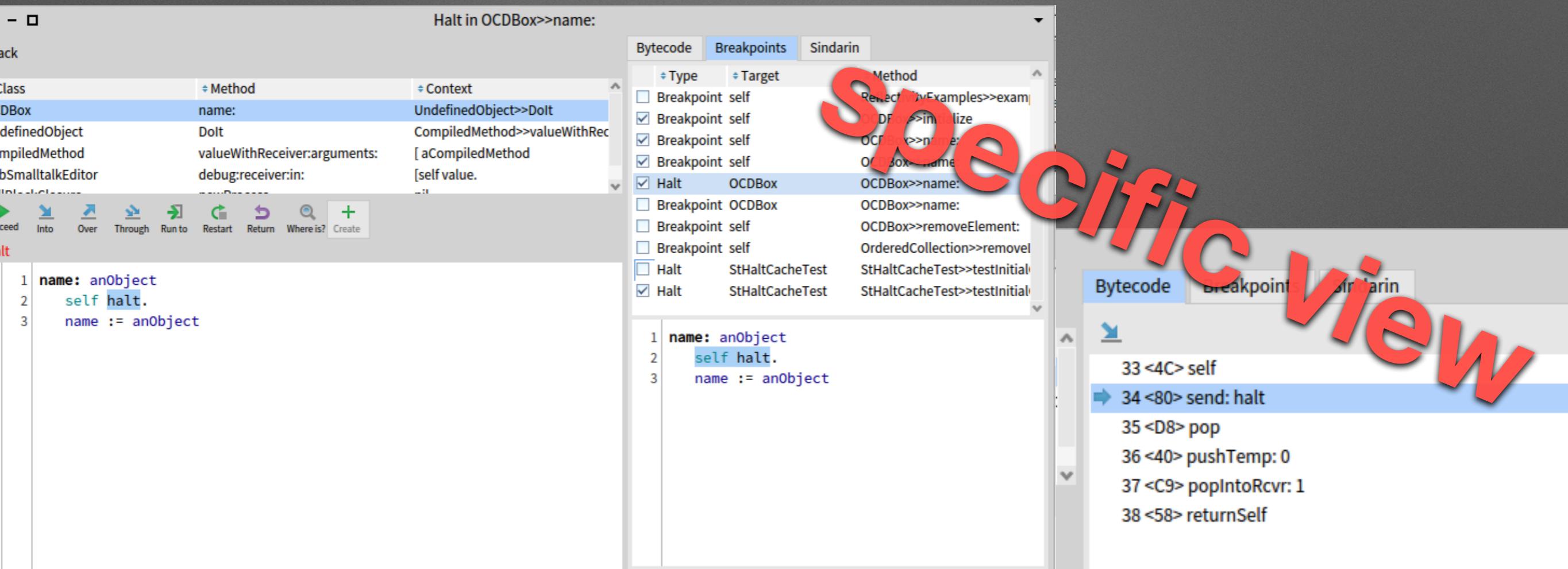
Source

🔍 Where is? 📄 Browse

```
generateCodeSegmentsCollectionWith: aPDFGenerator styleSheet: compositeStyleSheet format: aFormat
^ (self getSubElementsWith: aPDFGenerator styleSheet: compositeStyleSheet)
  collect: [ :aSubElement |
    aSubElement
      generateCodeSegmentWith: aPDFGenerator
      styleSheet: (aSubElement buildCompositeStyleSheetFrom: compositeStyleSheet)
      format: aFormat ]
```

Variables

Type	Variable	Value
implicit	self	a PDFCellElement
parameter	aFormat	a PDFA4Format
parameter	aPDFGenerator	a PDFGenerator
parameter	compositeStyleSheet	a StyleSheet
	dimension:	80 mm @ 20 mm;



A specific parser compiler debugger

The screenshot shows a debugger interface with several panels:

- Parser Stack:** Shows the current stack frame with symbols like Expression, StatementList, and MemberExpression.
- Possible Actions:** A table showing actions for symbols like IdentifierName.
- Input:** The source code being parsed, which includes JavaScript code for NodeList events and a stack trace.
- Stack:** A call stack showing the execution flow through various parser classes.
- Source:** The source code of the parser class, specifically the `performParsingStep` method.
- Bytecode GT:** A panel showing bytecode information.

The source code in the `performParsingStep` method is as follows:

```

self restoreState currentState.
(tryAllStates and: [ self isEOFToken ])
    ifTrue: [ ^ self processEOFToken ].
currentToken isPattern
    ifTrue: [ ^ self splitForPatternToken ].
[ actions := self actionsForCurrentToken.
actions isEmpty
    ifTrue: [ self killState.
        currentToken := nil.
        ^ self ].
2 to: actions size do: [ :i | self splitWithAction: (actions at: i) ].
action := actions first.
action = self acceptAction
    or: [ self performAction: action.
        currentToken isNil ] whileFalse.
action = self acceptAction
    ifTrue: [ currentState markAccepted ]

```

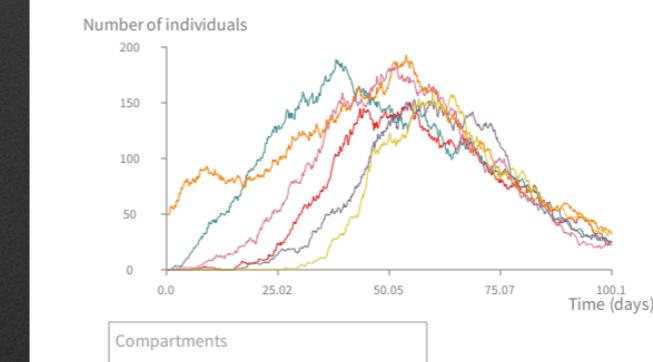
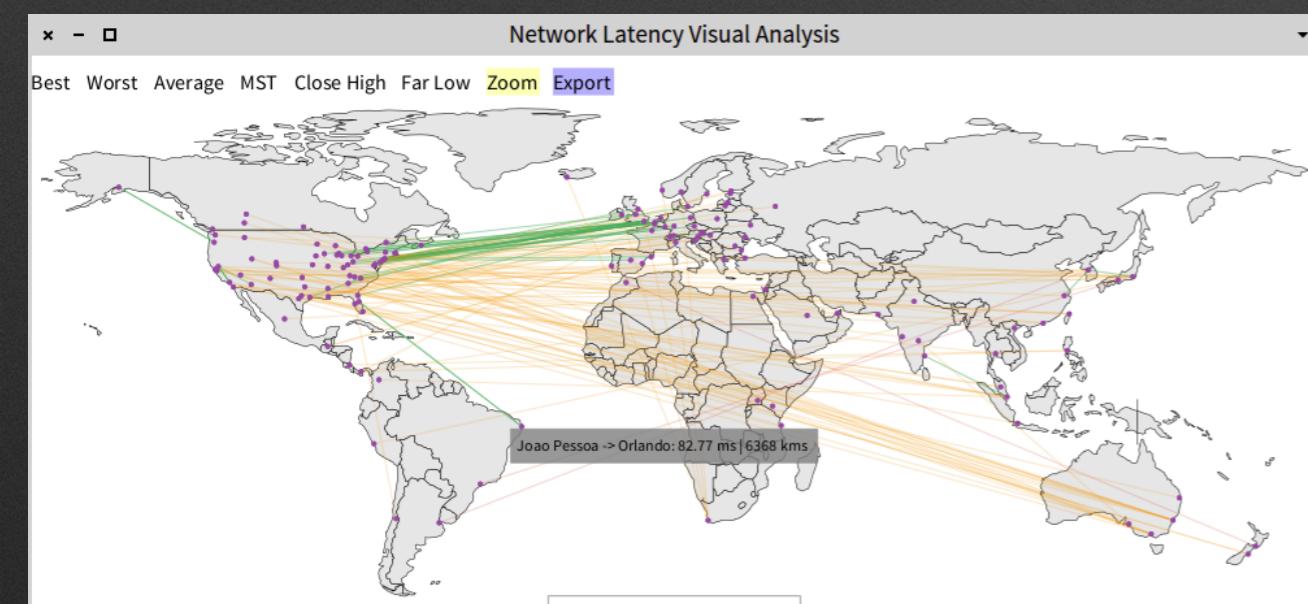
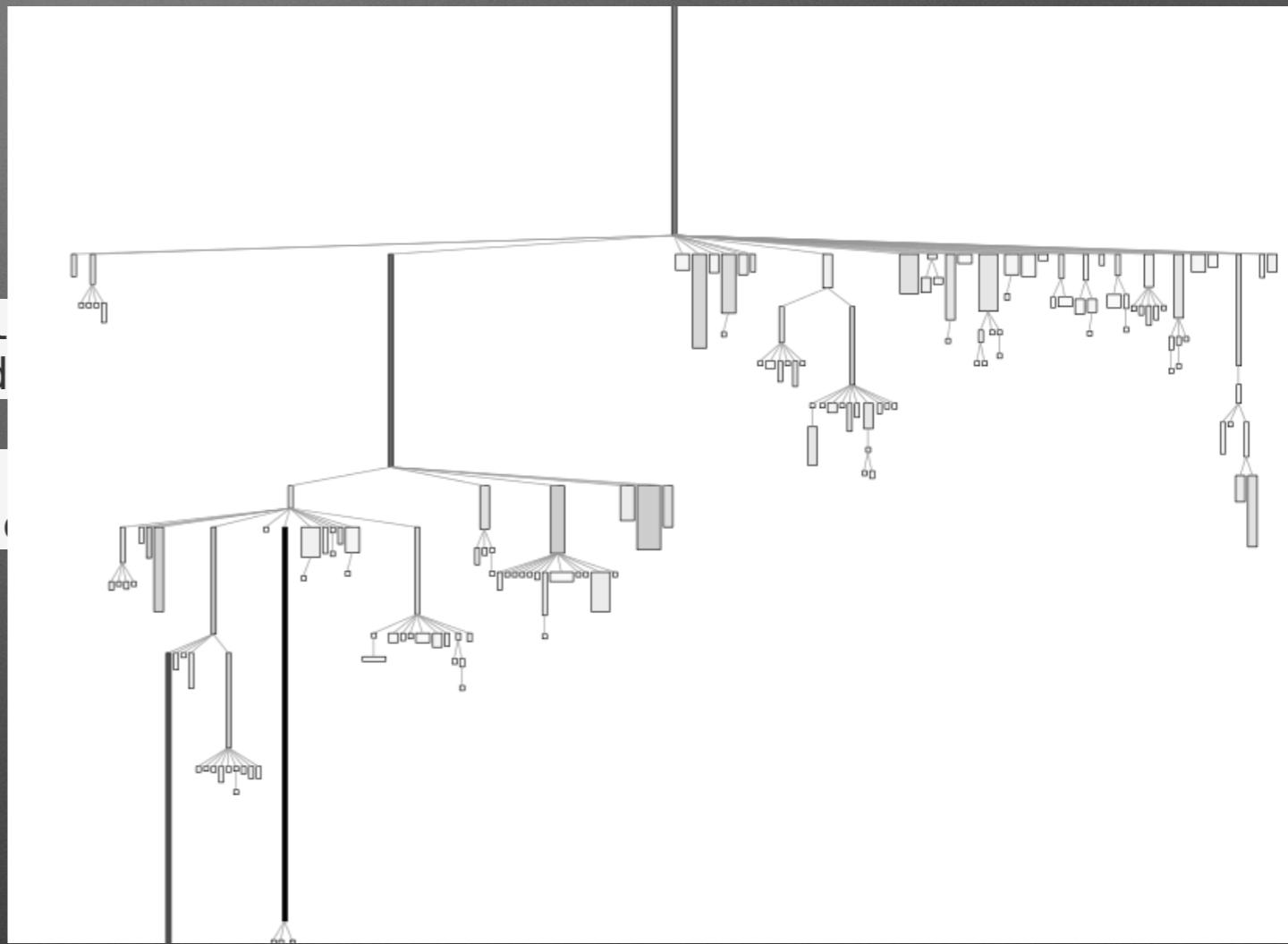
Live visualisation scripting

- The next level
- Roassal 30 by Prof. A. Bergel/Object Profile University of Chile at Santiago
- Simply gorgeous
- Check <http://agilevisualization.com>

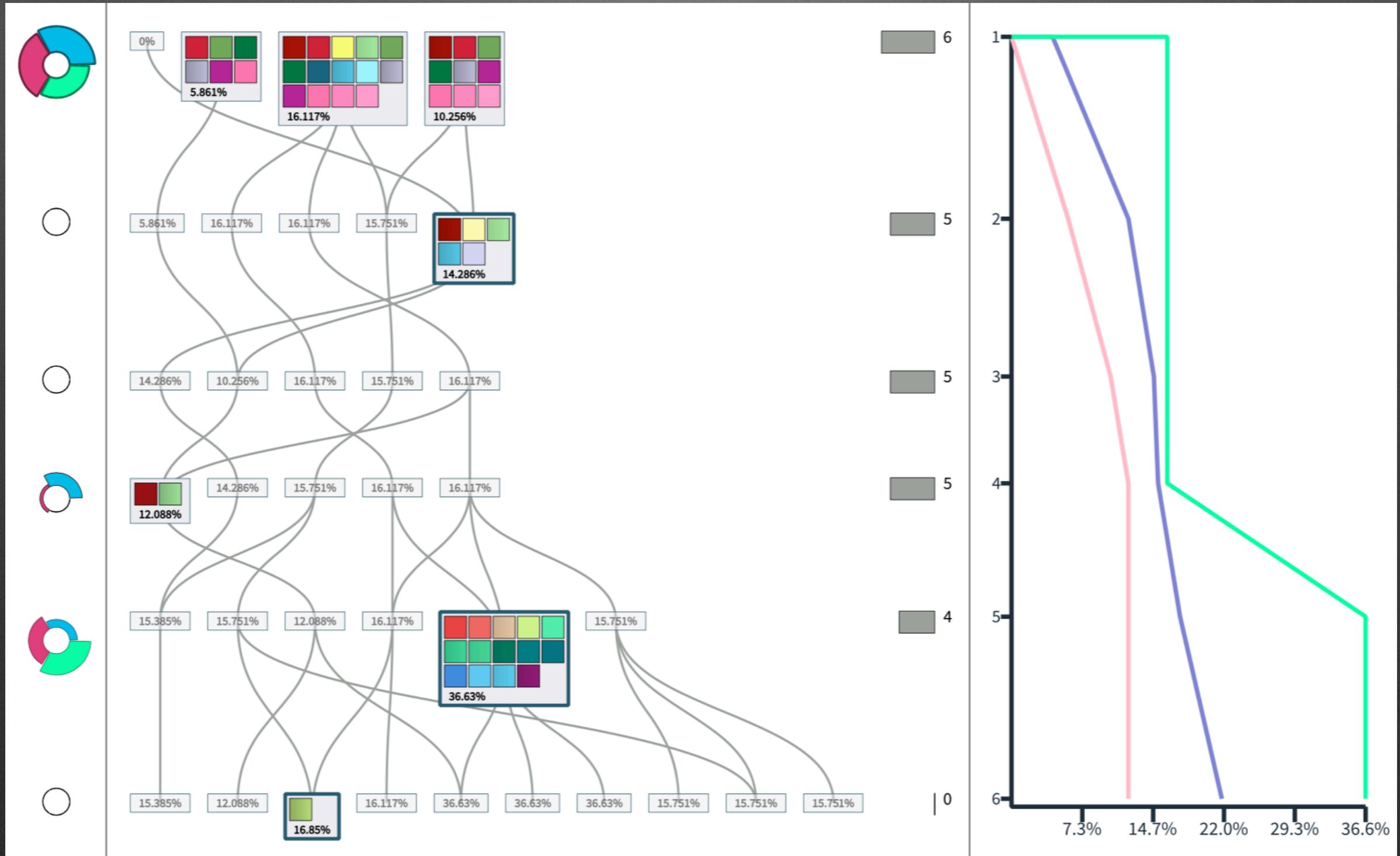
Scripting visualisations

```
b := RTMondrian new.  
b shape rectangle  
withBorder;  
width: [ :cls | cls numberOfVariables ]  
height: [ :cls | cls numberOfMethods ]
```

```
b nodes: Collection withAllSubclasses.  
b edges connectToAll: [ :cls | cls subclasses ].  
b layout tree.  
b normalizer  
normalizeColorAsGray: [ :cls |  
cls numberOfLinesOfCode ].  
b
```

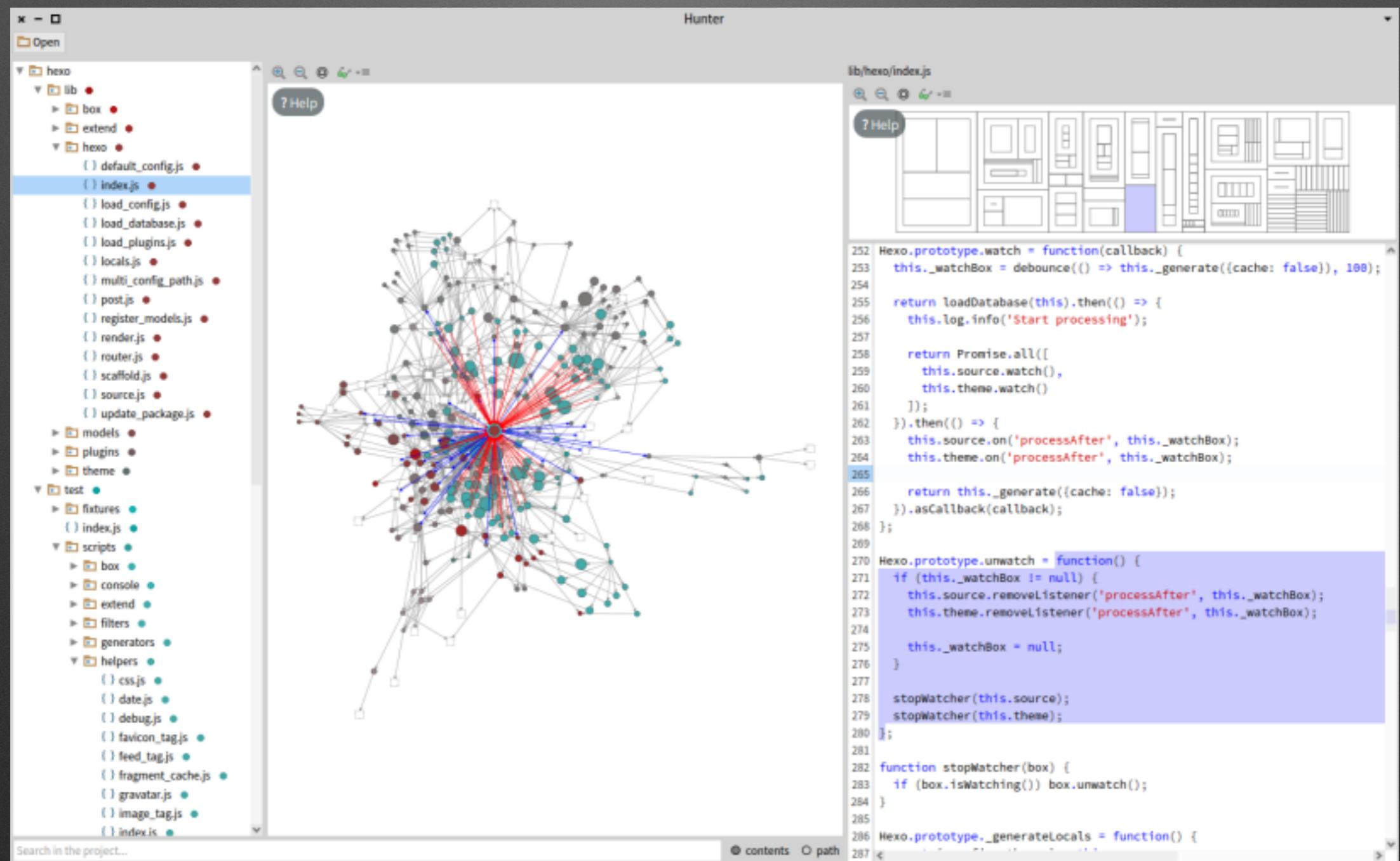


Execution of IA generating tests

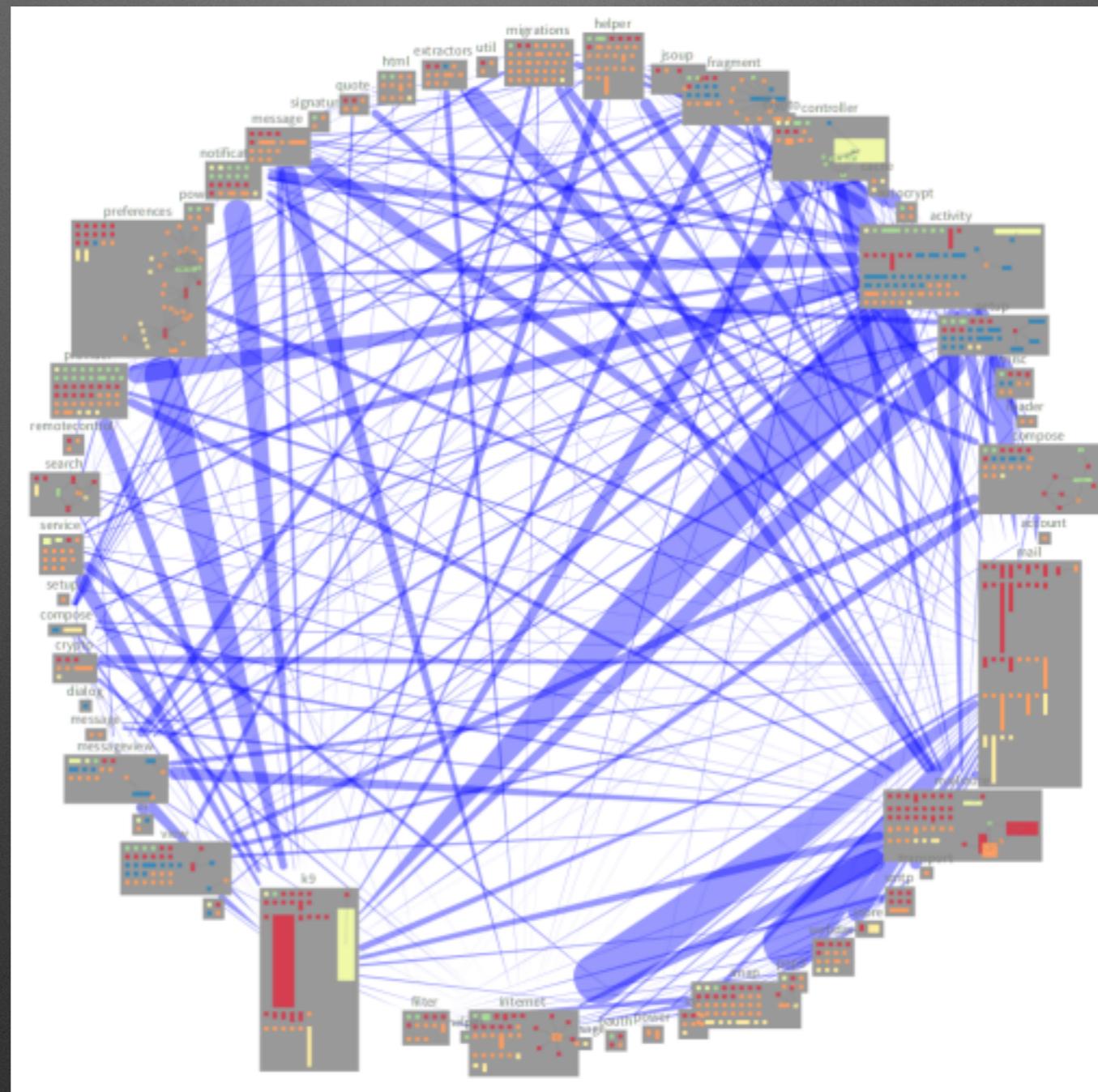


Building your own tool

- Javascript analysis

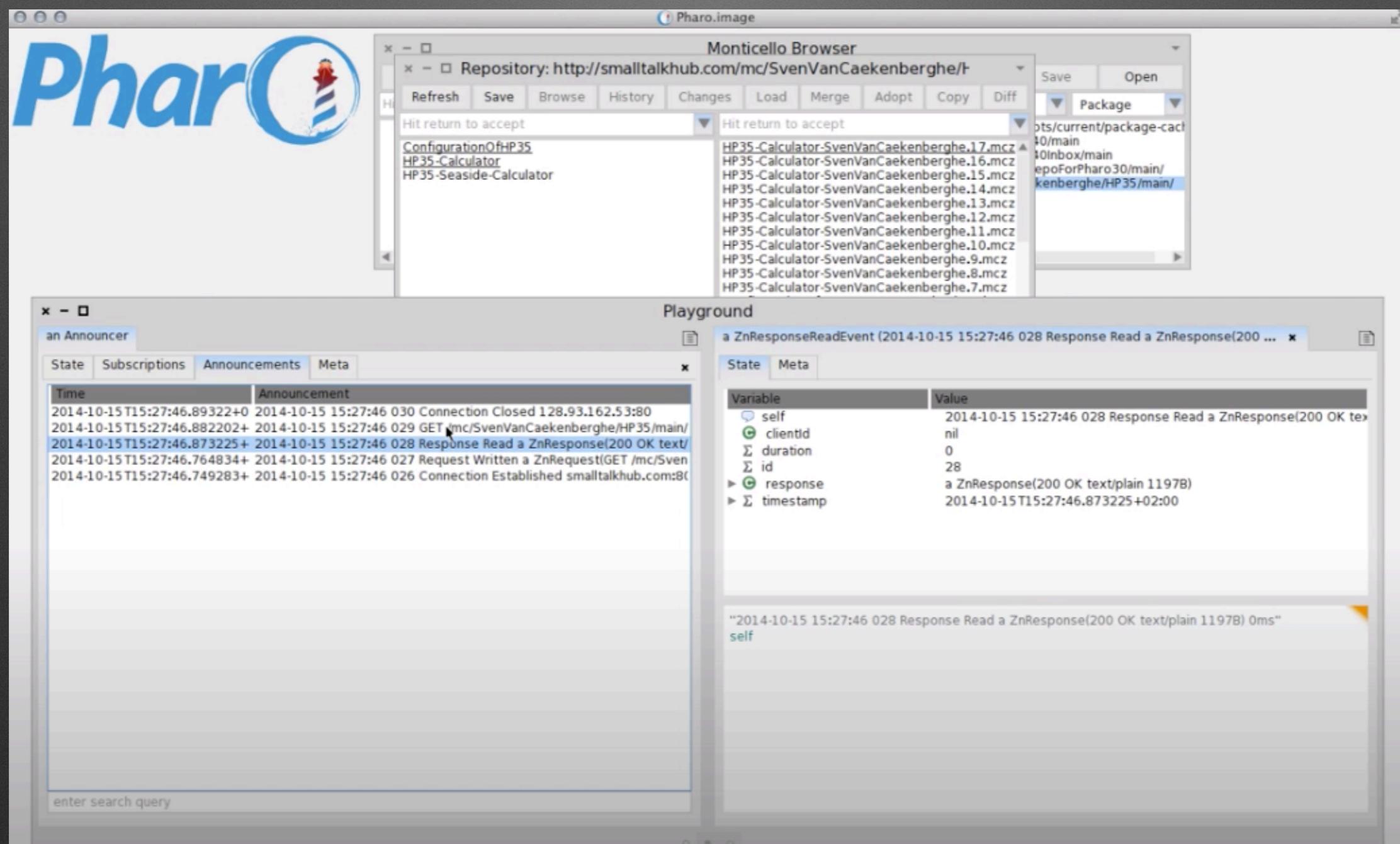


Analysis Android application



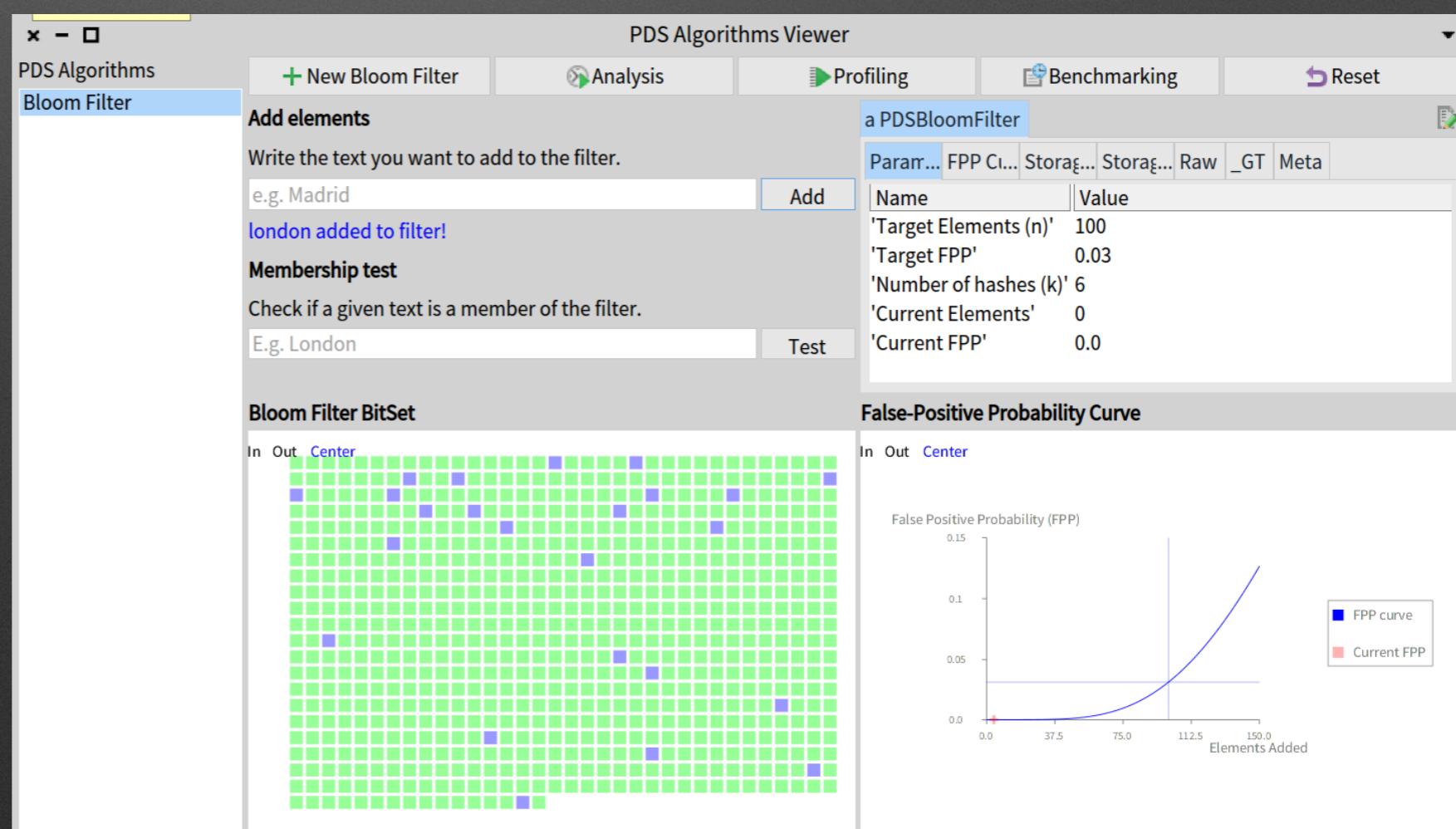
HTTP traffic analysis

- <http://youtu.be/rIBbeMdFCys>



Probabilistic Data Structure

- <https://github.com/osoco/PharoPDS>
- Defined new data structures
- And the analysis tools



Empowering is the right word

- Moldable tools are powerful
- Productivity boost
- Tried to give you my feeling
- But “The idea of experience does not replace experience.” Alain

There is a meta question

**How to invent new things with
the same tools than any body
else?**



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



WATT