Immersive experiences in Pharo:

what Pharo users are doing!

http://stephane.ducasse.free.fr
http://www.pharo.org
http://consortium.pharo.org

SCHMIDT
Ingenieurbüro für Bauwesen

inria
INVENTEURS DU MONDE NUMÉRIQUE

Lifeware

ENSTA
Bretagne

THALES

ZWEIDENKER

y
Yesplan
Let's make it happen

Lam®
RESEARCH

esug
EUROPEAN SMALLTALK USER GROUP

projector
software

GEMTALK™
SYSTEMS

SpesenFuchs

InfOil

feenk

netstyle.ch

osoco software company

HD

inspired!

BetaNine
software engineering

telna

HRworks

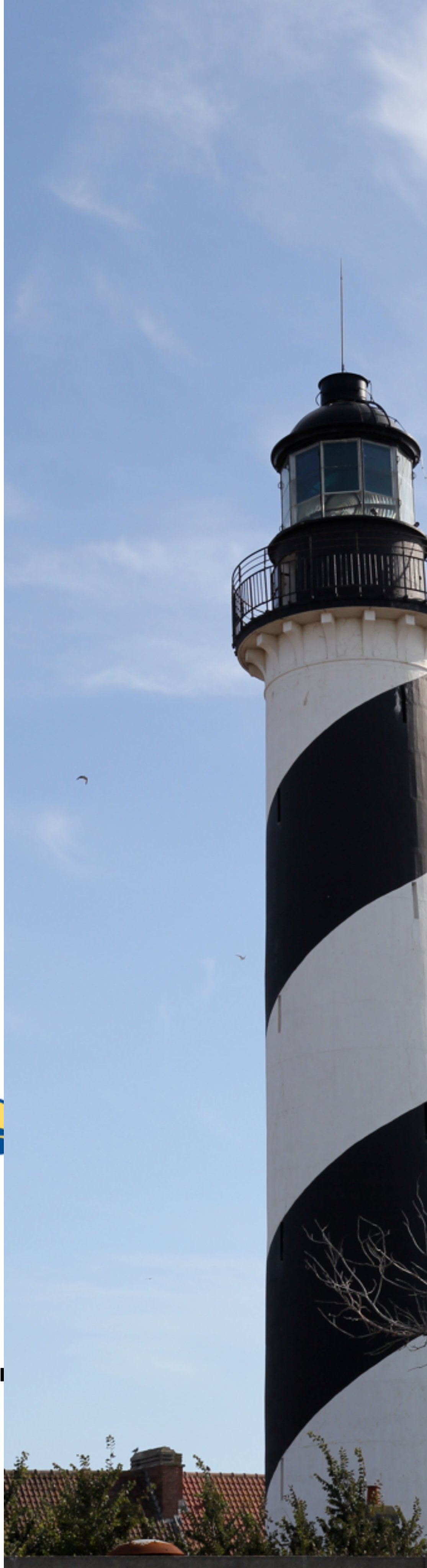
FINWORKS
INFORMATION TECHNOLOGY SOLUTIONS

Systems that make sense
Sensus

OBJECT
PROFILE

OBJECT GUILD
OG

TA MÈRESCRI
BADASS MOBILE DEVELOPMENT



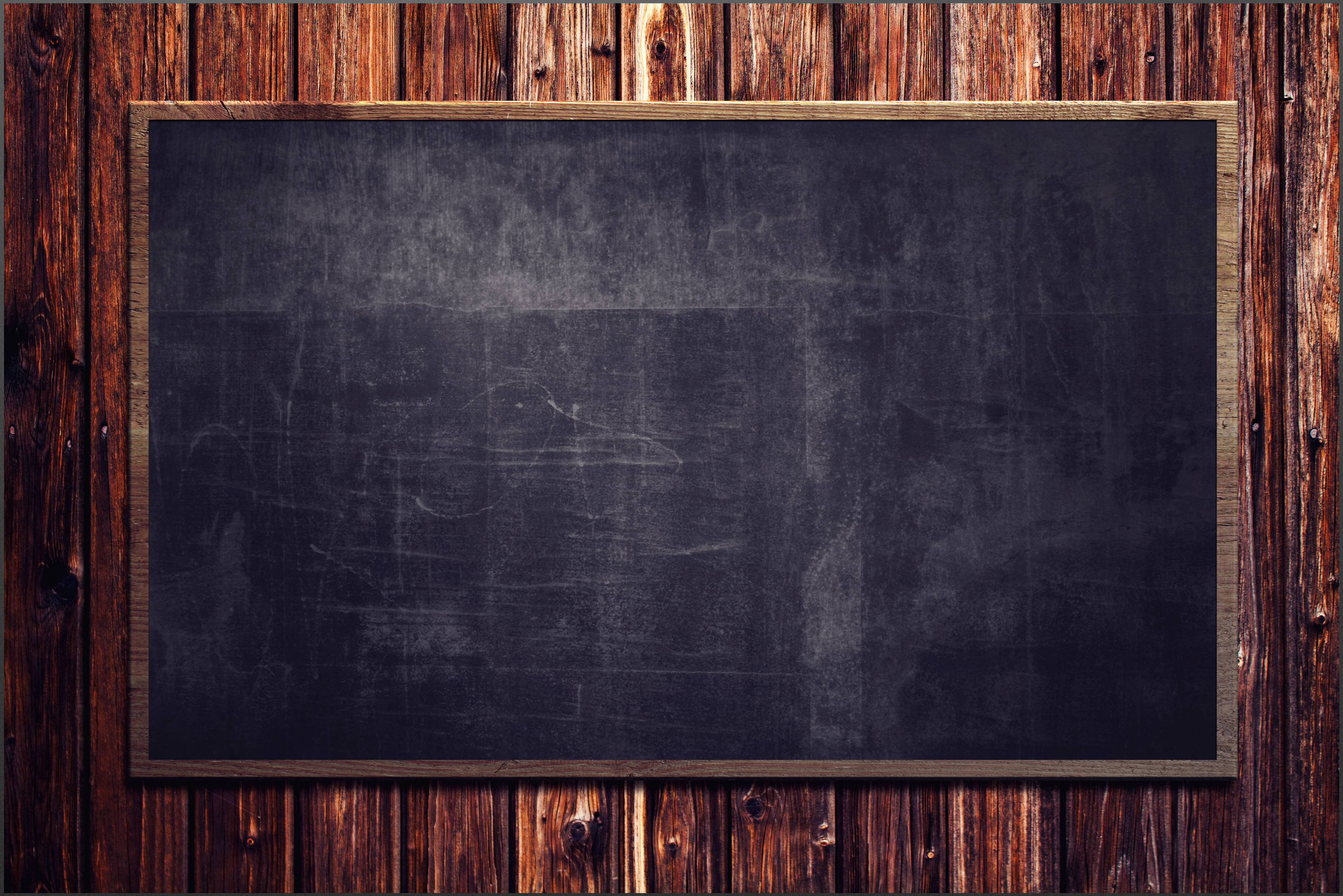
A journey in an immersive environment

- Appetizer first
- Pharo in 5 min
- Music, 3D, Graphics and more in Pharo

Pharo is highly immersive

if a compiler would be an aquarium

compiling a program would like writing on a black board

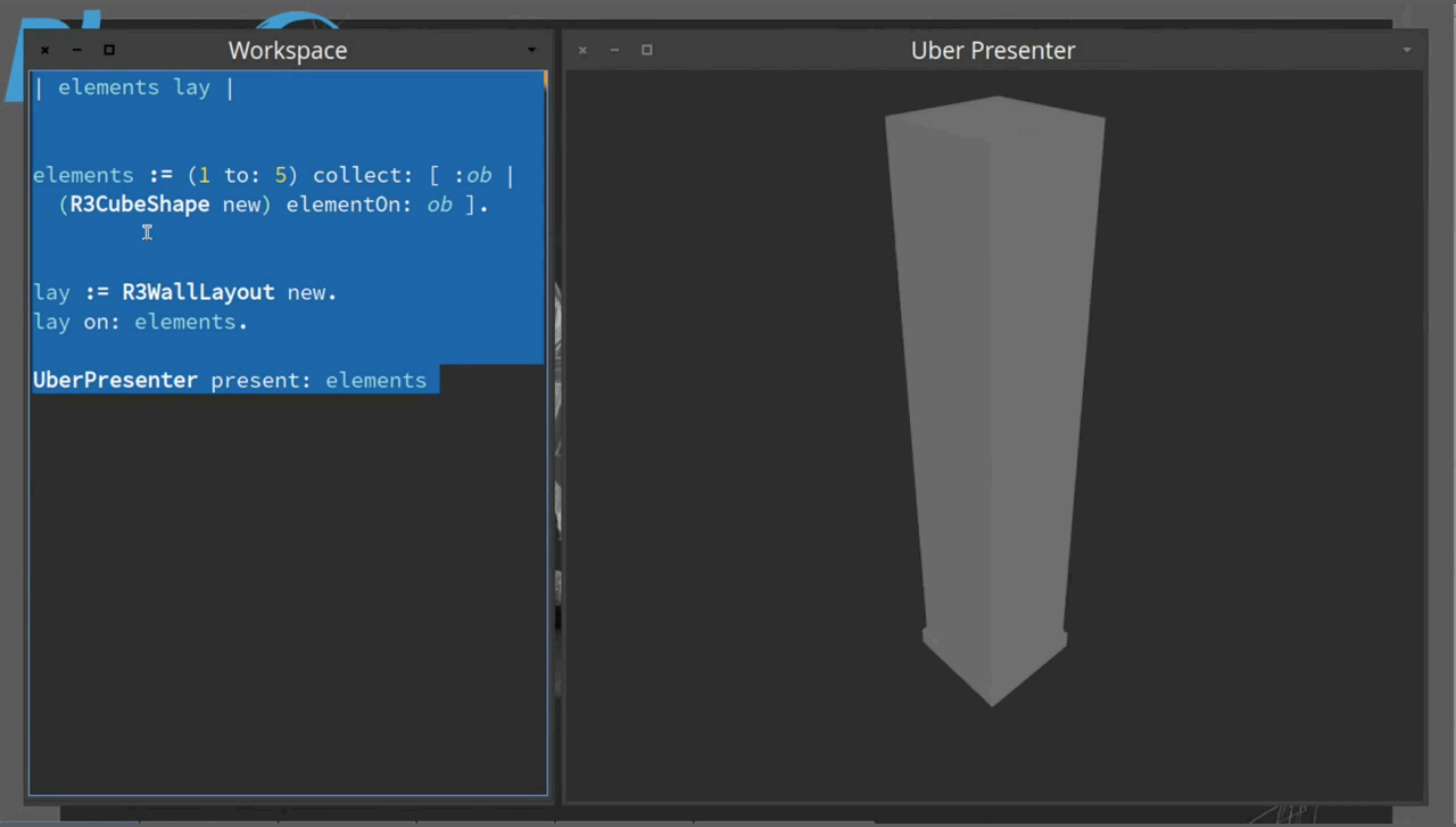


Immersing…

Pharo is not a blackbox

Everything is fully inspectable and reflective

You are immersed and interacting with objects



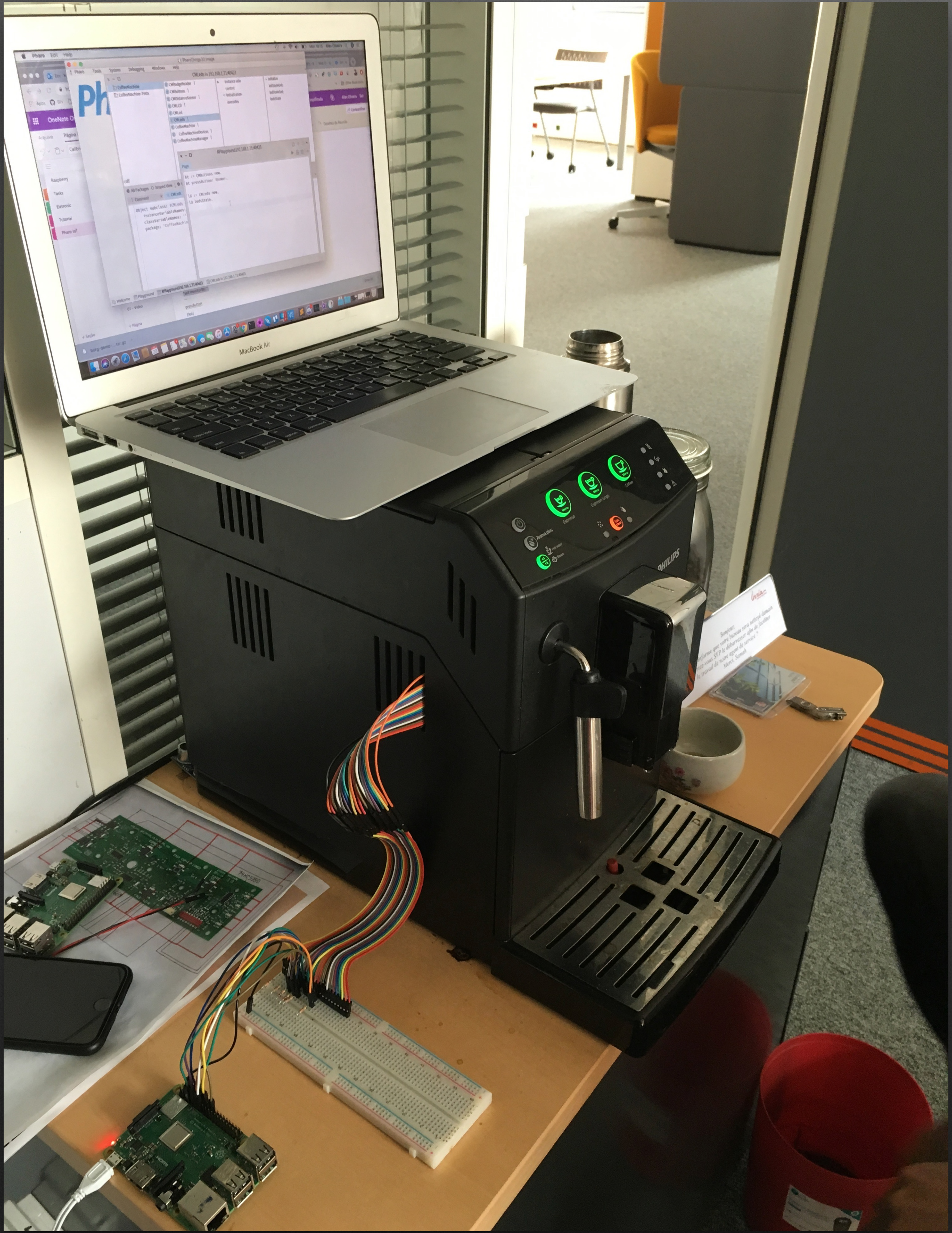
```
| elements lay |


elements := (1 to: 5) collect: [ :ob |
  (R3CubeShape new) elementOn: ob ].


lay := R3WallLayout new.
lay on: elements.

UberPresenter present: elements
```

We can do the same with
web app, sockets, networks,
sensors, living programing….



Hackers scripting live the coffee machine

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Pharo!

- System: Pure object language + full IDE
- Powerful, elegant and fun to program
- Living system under your fingers
- Works on Mac OSX, Linux(es), iOS, Windows, Pi,
- 100% MIT

Pharo in Numbers

17 releases since 2008

Language Core + IDE + Tools + Frameworks

~800 packages (tests included)

~ 27000 tests

5 platforms (11 Oses)

# 10k classes

# 137k methods

61 Mb (64 bits)

http://github.com/pharo-project/Pharo (~330 forks, 15/123 international contributors)

Growing ecosystem

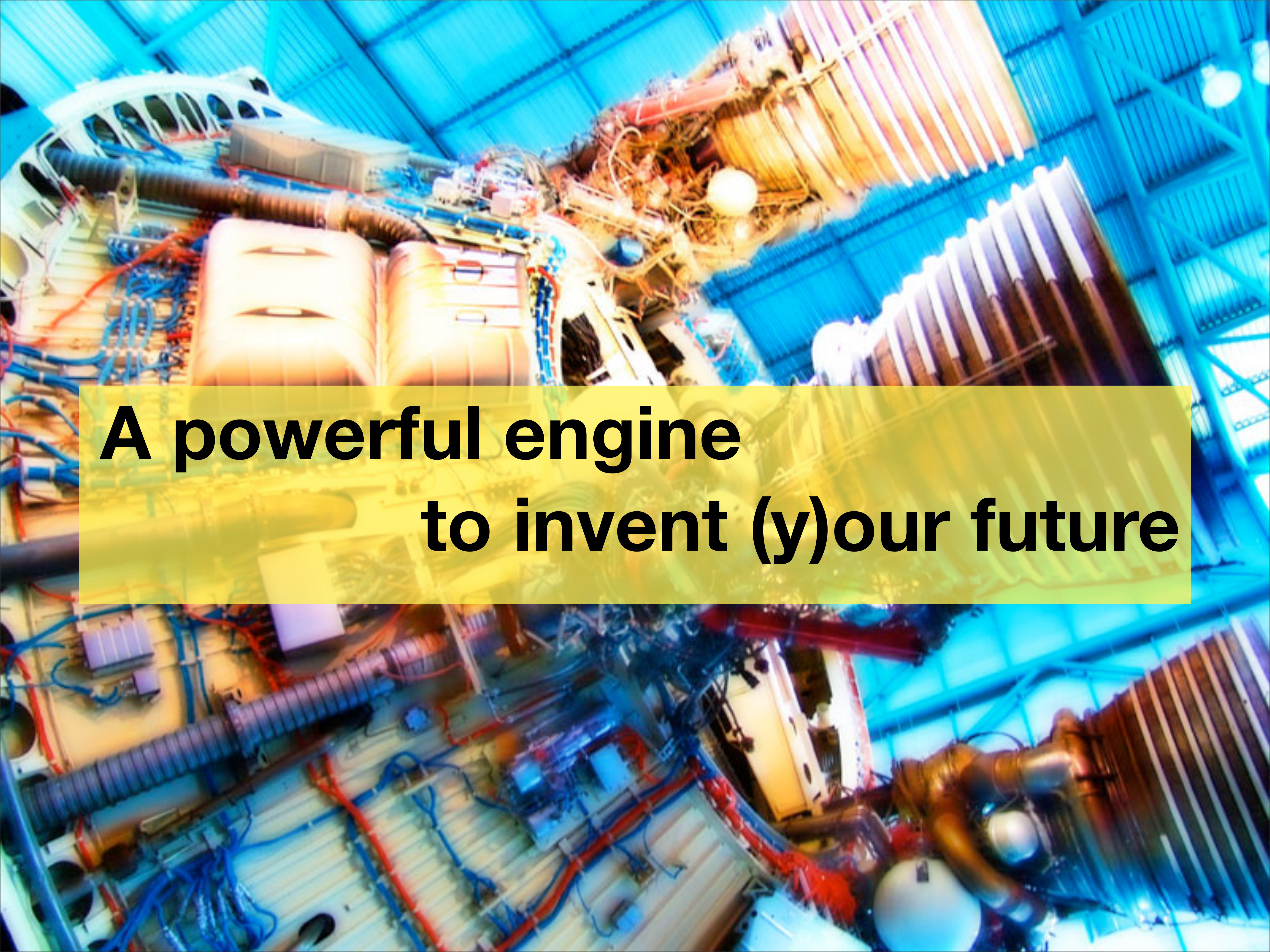
polymath

pharo-graphics

pharo-gis

pharo-container

pharo-ai



A powerful engine

to invent (y)our future

An ecosystem where innovation/business bloom

Some Success Stories @ pharo.org/success

trentosur

Soluciones móviles para retail y trade marketing

Captura la información directamente en su lugar de origen

Nos enfocamos en lo que importa del negocio

sin perder de vista los detalles de su implementación.

Primero móvil

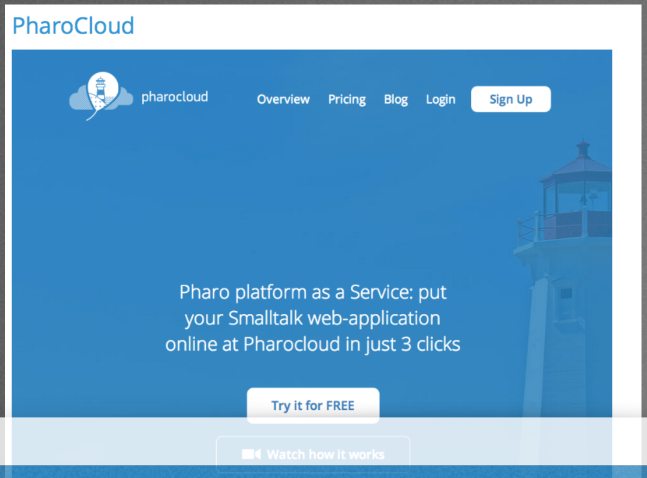
Centramos nuestras soluciones en la experiencia móvil.

Plataforma Android

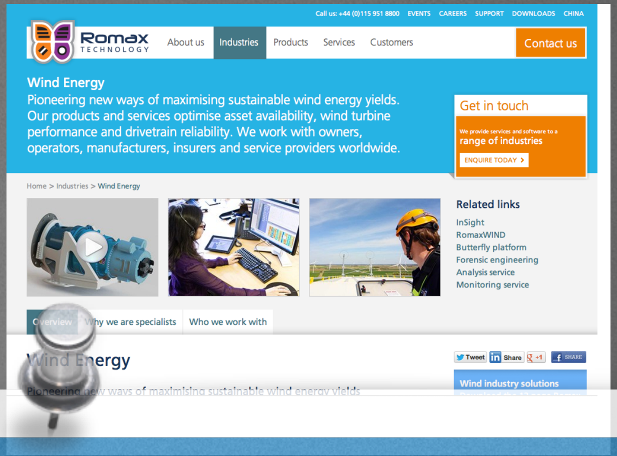
Aplicaciones nativas para el sistema operativo que cuenta con más de 900 millones de dispositivos activados.

En la nube

Soluciones que escalan de manera robusta y eficiente de acuerdo a la demanda de uso.


PharoCloud

Pharo platform as a Service: put your Smalltalk web-application online at Pharocloud in just 3 clicks



Wind Energy

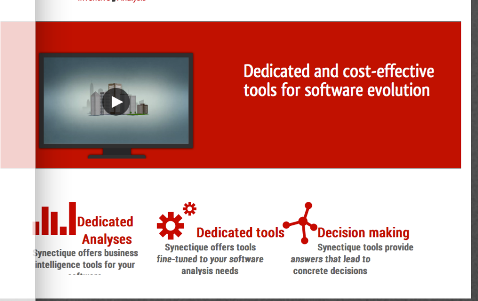
Pioneering new ways of maximising sustainable wind energy yields. Our products and services optimise asset availability, wind turbine performance and drivetrain reliability. We work with owners, operators, manufacturers, insurers and service providers worldwide.

Wind Energy

webstyle.ch

WEBDRUCK.CH
Web-To-Print Solution

- Design and create individual printed matter
- eShop with credit card payment
- High quality PDF output with Printing Process integration
- Thousands of orders for seven Swiss printing companies


Dedicated and cost-effective tools for software evolution

Dedicated Analyses

Synectique offers business intelligence tools for your

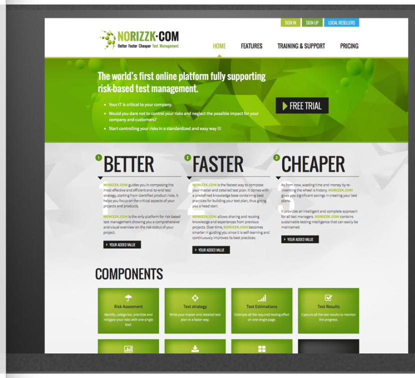
Dedicated tools

Synectique offers tools fine-tuned to your software analysis needs

Decision making

Synectique tools provide answers that lead to concrete decisions

Quuve


NORIZZK.COM

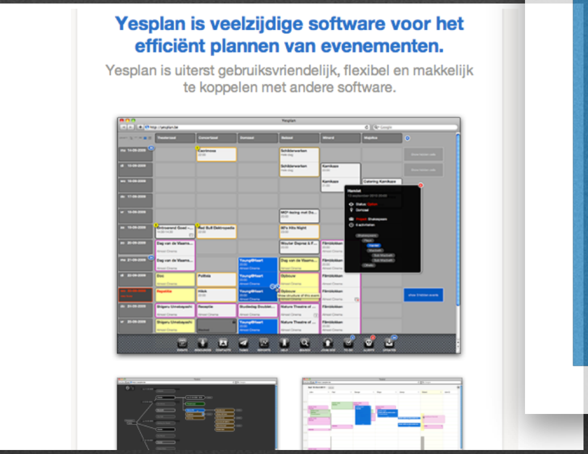
The world's first online platform fully supporting risk-based test management.

BETTER

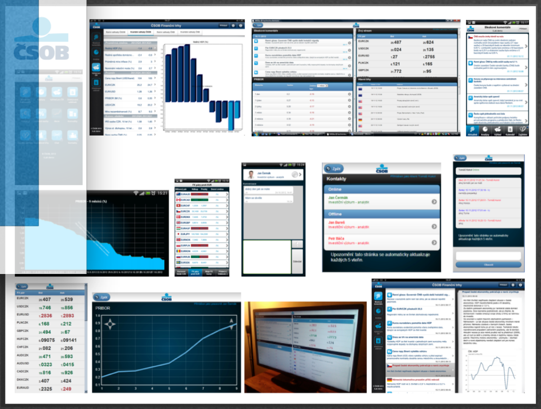
FASTER

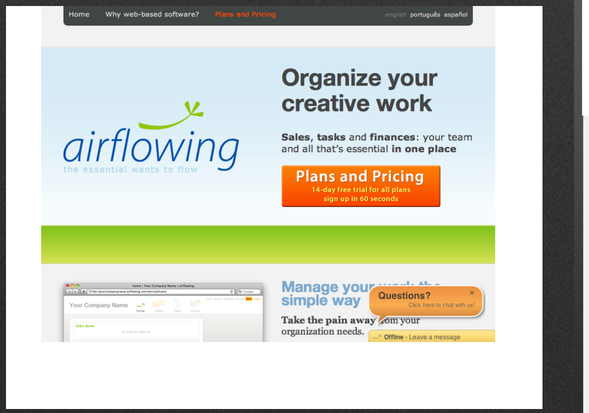
CHEAPER

COMPONENTS


Yesplan is veelzijdige software voor het efficiënt plannen van evenementen.

Yesplan is uiterst gebruiksvriendelijk, flexibel en makkelijk te koppelen met andere software.





airflowing

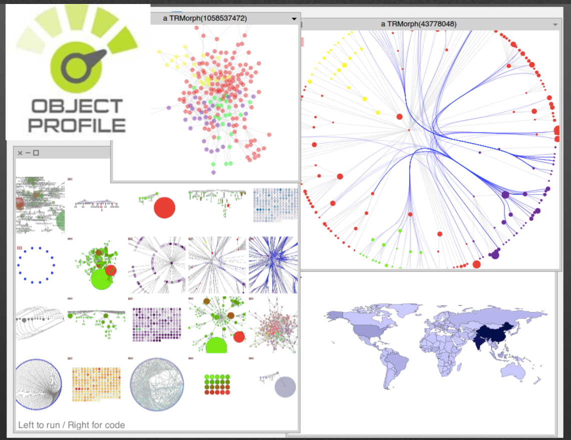
the essential wants to flow

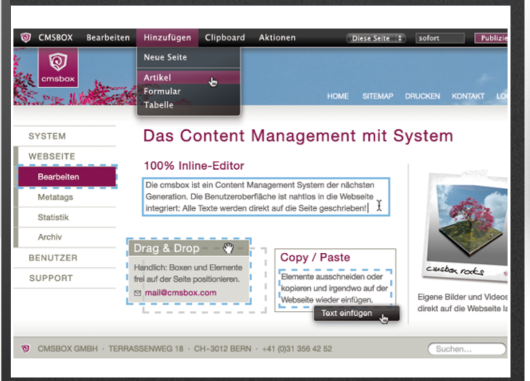
Organize your creative work

Sales, tasks and finances: your team and all that's essential in one place

Manage your work the simple way

Take the pain away from your organization needs.


OBJECT PROFILE



Das Content Management mit System

100% Inline-Editor

Die cmsbox ist ein Content Management System der nächsten Generation. Die Benutzeroberfläche ist nahtlos in die Webseite integriert: Alle Texte werden direkt auf die Seite geschrieben!

Drag & Drop

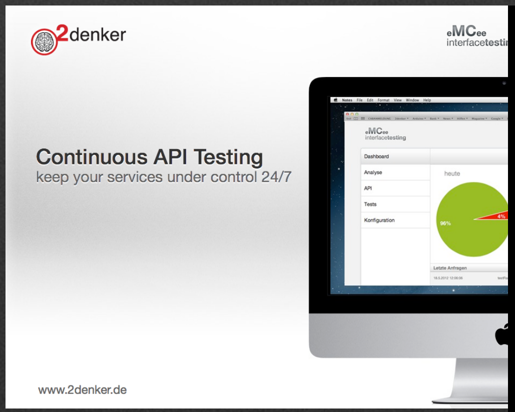
Handlich: Boxen und Elemente frei auf der Seite positionieren.

Copy / Paste

Elemente ausschneiden oder kopieren und irgendwo auf der Webseite wieder einfügen.

Eigene Bilder und Videos direkt auf die Webseite

CMSBOX GMBH · TERRASSENWEG 18 · CH-3012 BERN · +41 (0)31 356 42 52

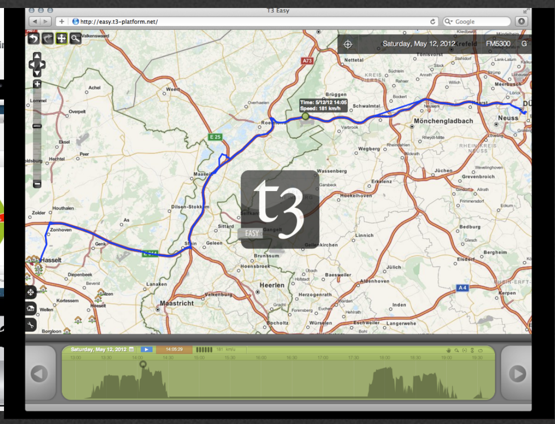

2denker

MC interfacetesting

Continuous API Testing

keep your services under control 24/7

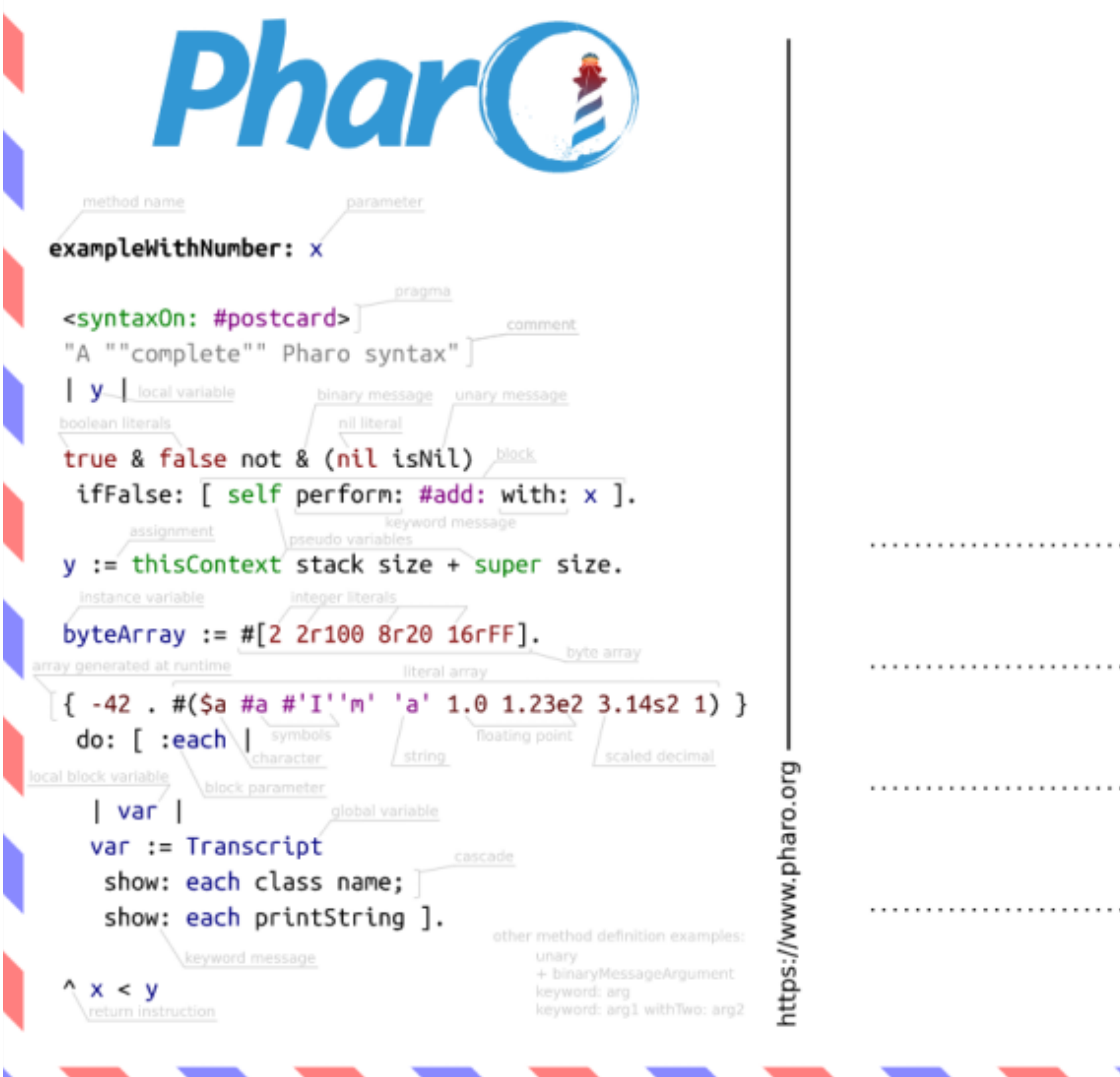
www.2denker.de



Pharo is our vehicle
We improve it everyday

Elegant!

- Full syntax on a postcard
- Simple and powerful objet model



```
exampleWithNumber: x

 <syntaxOn: #postcard>
 "A ""complete"" Pharo syntax"
 | y |
 true & false not & (nil isNil)
  ifFalse: [ self perform: #add: with: x ].

 y := thisContext stack size + super size.

 byteArray := #[2 2r100 8r20 16rFF].

 { -42 . #($a #a #'I''m' 'a' 1.0 1.23e2 3.14s2 1) }
  do: [ :each |
    | var |
    var := Transcript
     show: each class name;
     show: each printString ].

 ^ x < y
```

other method definition examples:

```
unary
+ binaryMessageArgument
keyword: arg
keyword: arg1 withTwo: arg2
```

Yes the full Syntax!

Yes there is nothing else…

A Pure World of Objects

Only

objects + messages +

closures

mouse, booleans, arrays, numbers, strings, windows, scrollbars, canvas, files, trees, compilers, sound, url, socket, fonts, text, collections, stack, shortcut, streams, …

A journey in an immersive environment

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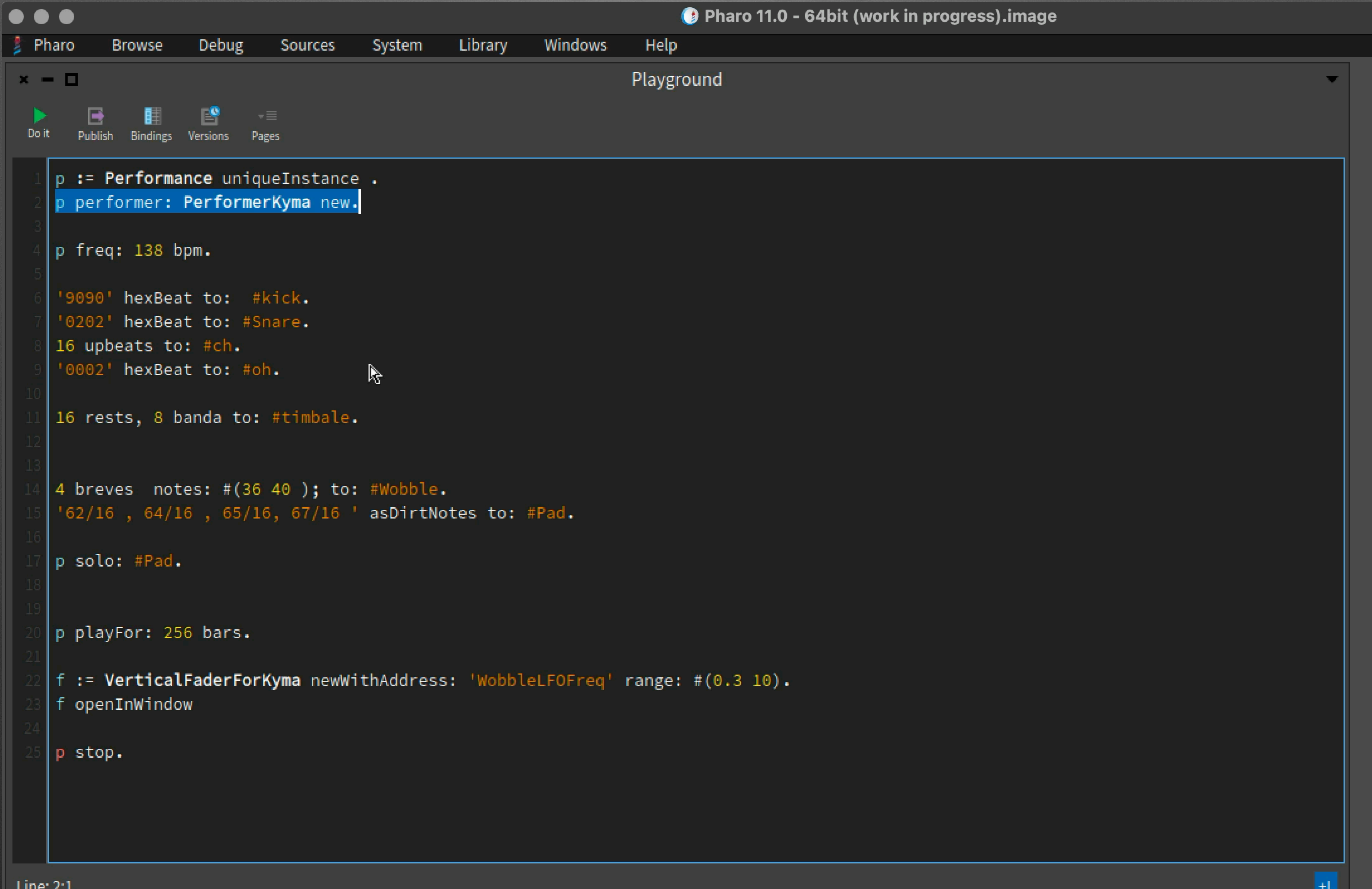
Live Music

D. Cipriano - DJ lucretio

- Live performance
- https://www.youtube.com/watch?v=4lhoYmI_ivs
- https://www.youtube.com/watch?v=S2Dff90aYDI
- Currently connecting Pharo live music with Faust

Live Music



```
p := Performance uniqueInstance .
p performer: PerformerKyma new.

p freq: 138 bpm.

'9090' hexBeat to:  #kick.
'0202' hexBeat to: #Snare.
16 upbeats to: #ch.
'0002' hexBeat to: #oh.

16 rests, 8 banda to: #timbale.


4 breves  notes: #(36 40 ); to: #Wobble.
'62/16 , 64/16 , 65/16, 67/16 ' asDirtNotes to: #Pad.

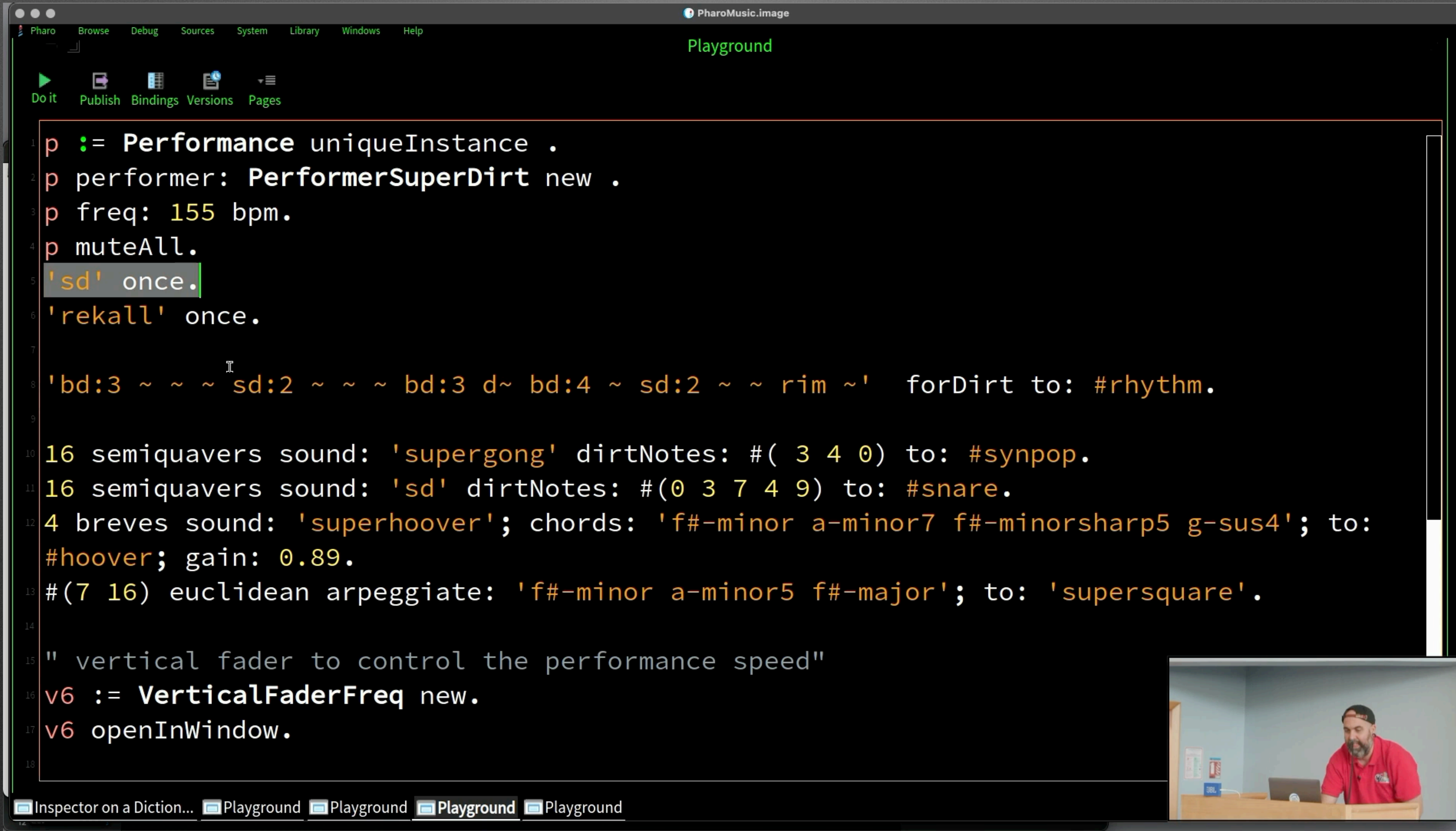
p solo: #Pad.


p playFor: 256 bars.

f := VerticalFaderForKyma newWithAddress: 'WobbleLFOFreq' range: #(0.3 10).
f openInWindow

p stop.
```

Live Music with SuperDirt



```
p := Performance uniqueInstance .
p performer: PerformerSuperDirt new .
p freq: 155 bpm.
p muteAll.
'sd' once.
'rekall' once.

'bd:3 ~ ~ ~ sd:2 ~ ~ ~ bd:3 d~ bd:4 ~ sd:2 ~ ~ rim ~'  forDirt to: #rhythm.

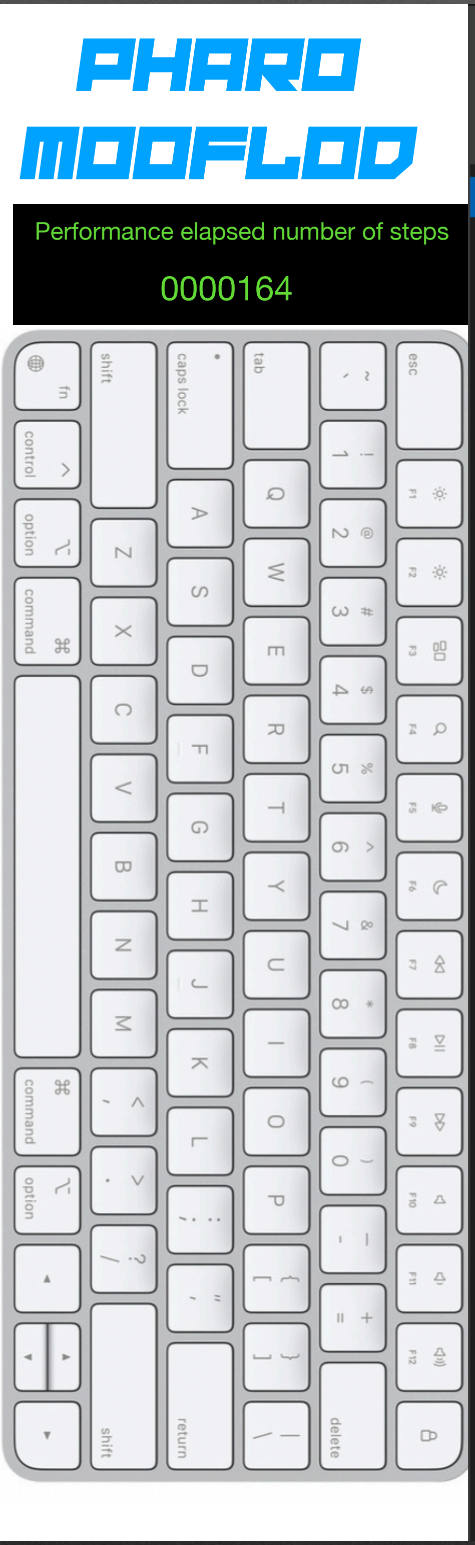
16 semiquavers sound: 'supergong' dirtNotes: #( 3 4 0) to: #synpop.
16 semiquavers sound: 'sd' dirtNotes: #(0 3 7 4 9) to: #snare.
4 breves sound: 'superhoover'; chords: 'f#-minor a-minor7 f#-minorsharp5 g-sus4'; to: #hoover; gain: 0.89.
#(7 16) euclidean arpeggiate: 'f#-minor a-minor5 f#-major'; to: 'supersquare'.

" vertical fader to control the performance speed"
v6 := VerticalFaderFreq new.
v6 openInWindow.
```

Coypu

- https://github.com/lucretiomsp/Coypu
- Interface via OSC
- Can talk to many external tools
- SuperDirt
- Phausto: Faust DSP inside Pharo

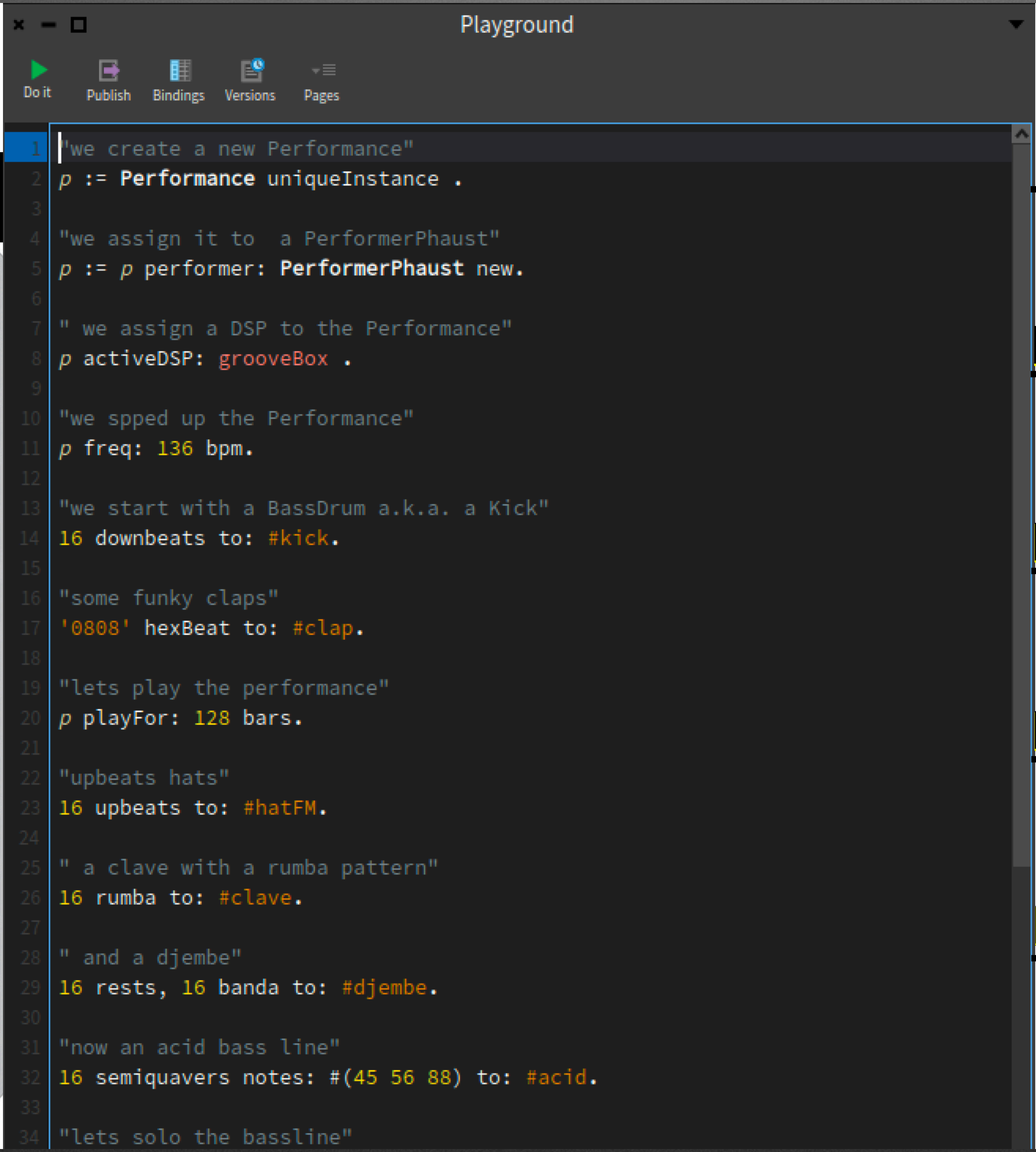
How spectators can understand shows?



PHARO MOOFLOD

Performance elapsed number of steps

0000164



```
"we create a new Performance"
p := Performance uniqueInstance .

"we assign it to  a PerformerPhaust"
p := p performer: PerformerPhaust new.

" we assign a DSP to the Performance"
p activeDSP: grooveBox .

"we spped up the Performance"
p freq: 136 bpm.

"we start with a BassDrum a.k.a. a Kick"
16 downbeats to: #kick.

"some funky claps"
'0808' hexBeat to: #clap.

"lets play the performance"
p playFor: 128 bars.

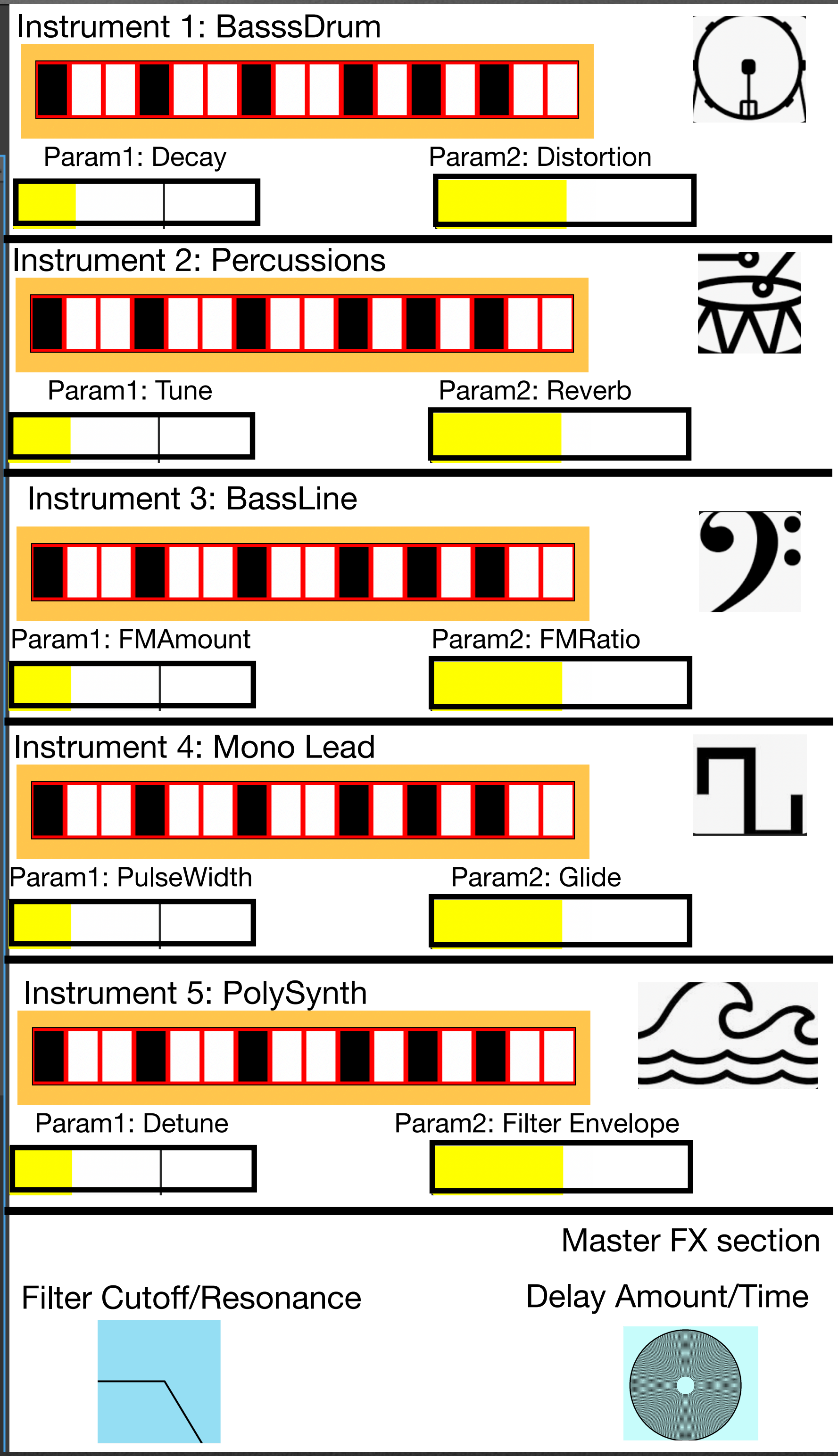
"upbeats hats"
16 upbeats to: #hatFM.

" a clave with a rumba pattern"
16 rumba to: #clave.

" and a djembe"
16 rests, 16 banda to: #djembe.

"now an acid bass line"
16 semiquavers notes: #(45 56 88) to: #acid.

"lets solo the bassline"
```



Instrument 1: BasssDrum

Param1: Decay Param2: Distortion

Instrument 2: Percussions

Param1: Tune Param2: Reverb

Instrument 3: BassLine

Param1: FMAmount Param2: FMRatio

Instrument 4: Mono Lead

Param1: PulseWidth Param2: Glide

Instrument 5: PolySynth

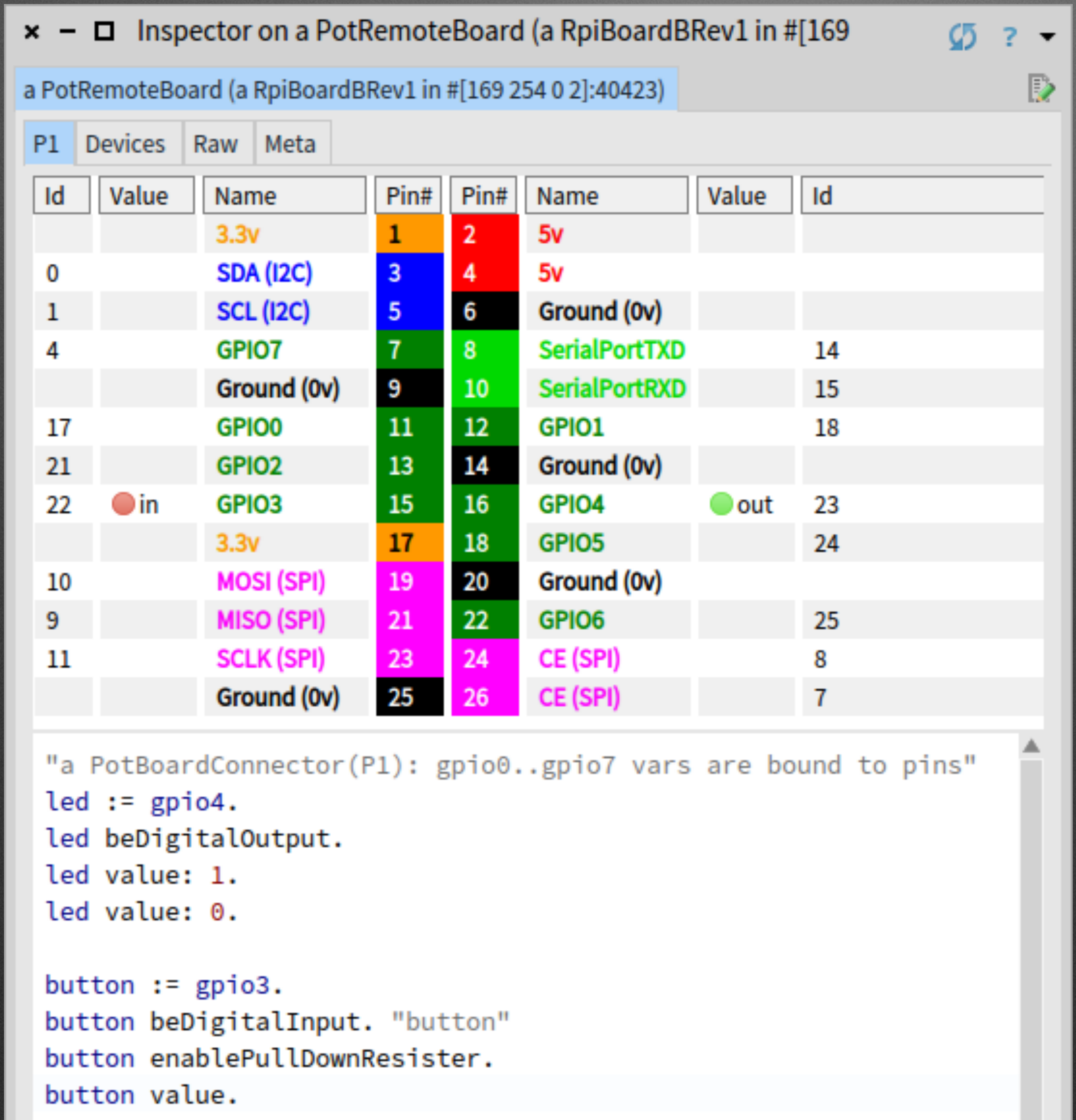
Param1: Detune Param2: Filter Envelope

Master FX section

Filter Cutoff/Resonance

Delay Amount/Time

Live equipment :)


Inspector on a PotRemoteBoard (a RpiBoardBRev1 in #[169
a PotRemoteBoard (a RpiBoardBRev1 in #[169 254 0 2]:40423)
P1
Devices
Raw
Meta

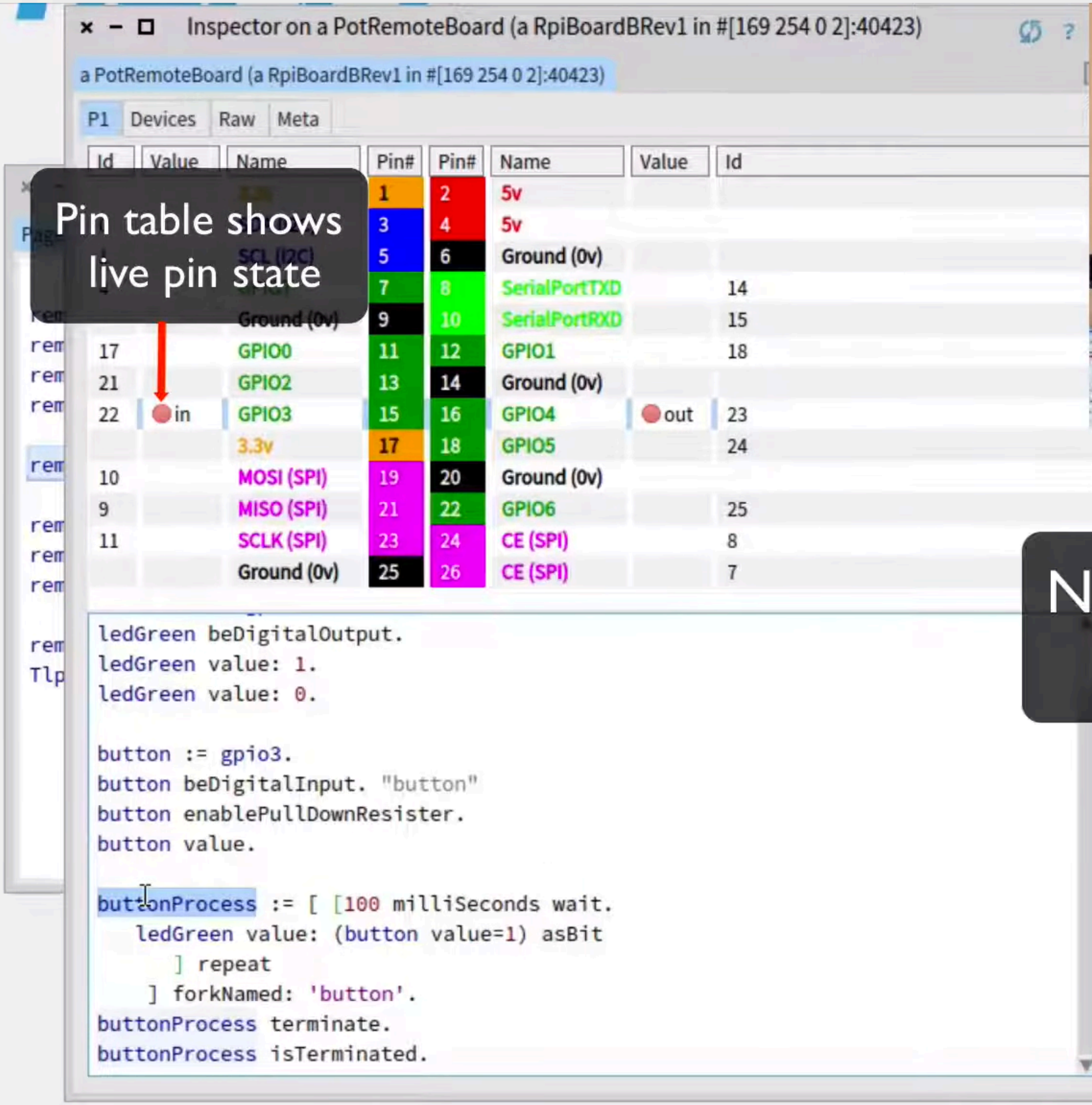
Id	Value	Name	Pin#	Pin#	Name	Value	Id
		3.3v	1	2	5v		
0		SDA (I2C)	3	4	5v		
1		SCL (I2C)	5	6	Ground (0v)		
4		GPIO7	7	8	SerialPortTXD		14
		Ground (0v)	9	10	SerialPortRXD		15
17		GPIO0	11	12	GPIO1		18
21		GPIO2	13	14	Ground (0v)		
22	● in	GPIO3	15	16	GPIO4	● out	23
		3.3v	17	18	GPIO5		24
10		MOSI (SPI)	19	20	Ground (0v)		
9		MISO (SPI)	21	22	GPIO6		25
11		SCLK (SPI)	23	24	CE (SPI)		8
		Ground (0v)	25	26	CE (SPI)		7

```
"a PotBoardConnector(P1): gpio0..gpio7 vars are bound to pins"
led := gpio4.
led beDigitalOutput.
led value: 1.
led value: 0.

button := gpio3.
button beDigitalInput. "button"
button enablePullDownResister.
button value.
```

Live board

PharoThings_ a demo about low level board model.mp4



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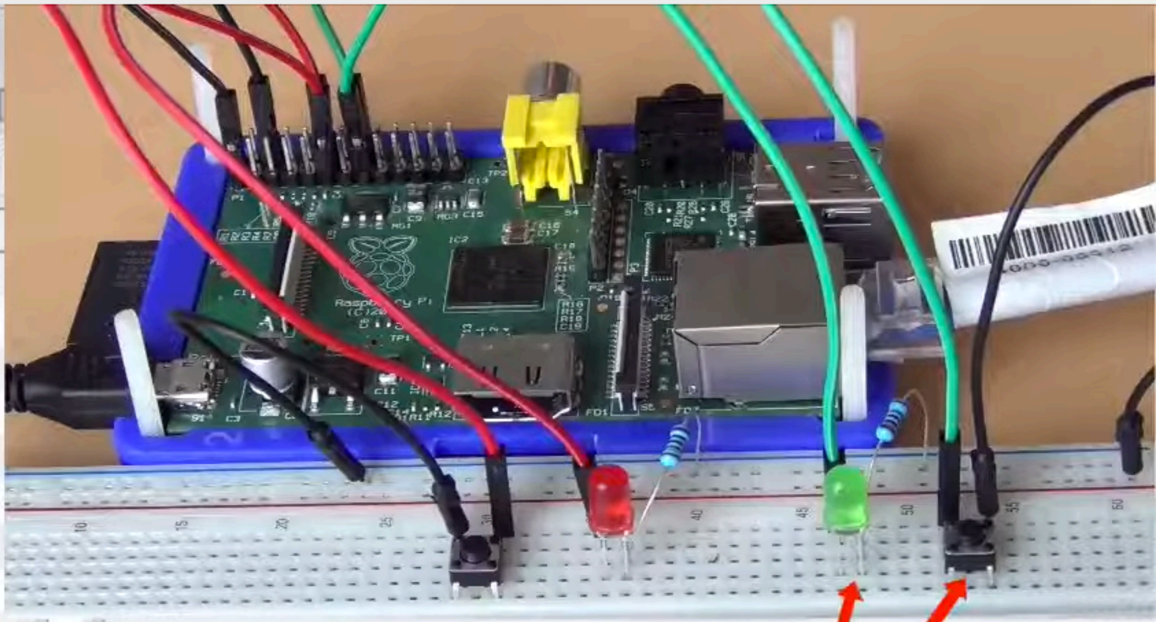
11		SCLK (SPI)	23	24	CE (SPI)		8
		Ground (0v)	25	26	CE (SPI)		7

```
ledGreen beDigitalOutput.
ledGreen value: 1.
ledGreen value: 0.

button := gpio3.
button beDigitalInput. "button"
button enablePullDownResister.
button value.

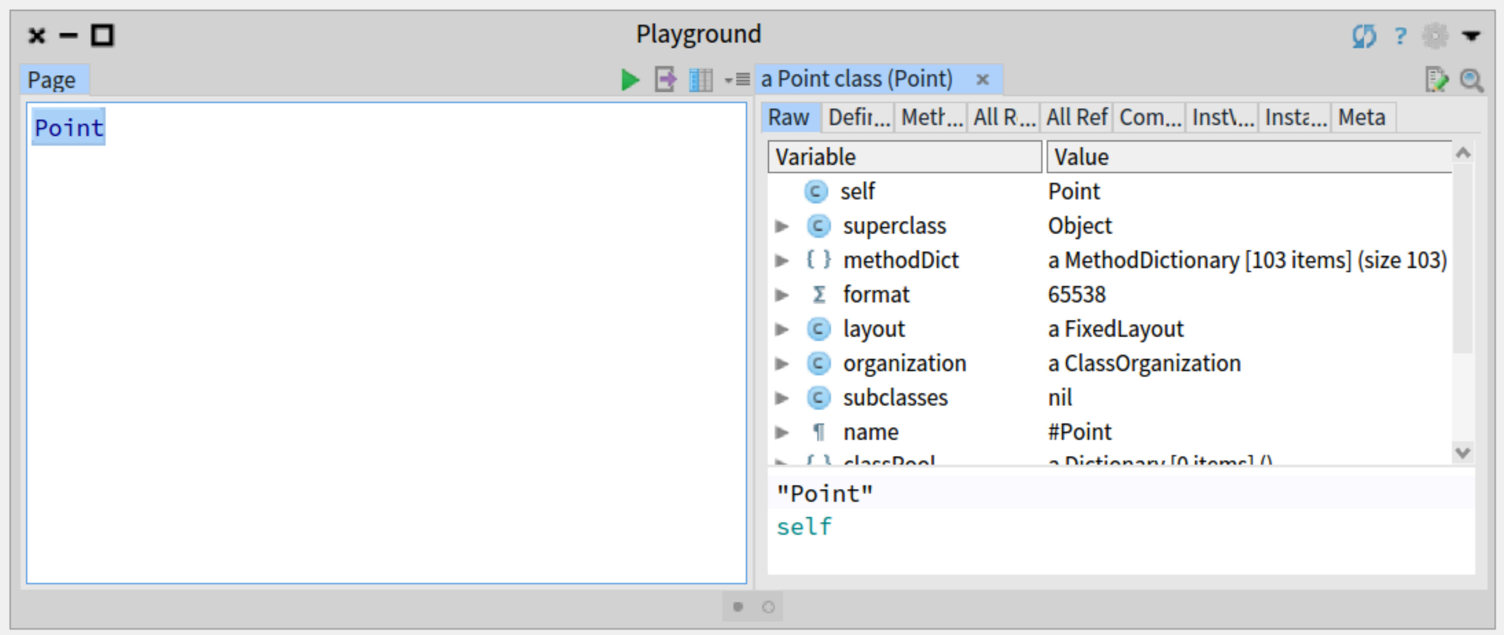
buttonProcess := [ [100 milliSeconds wait.
   ledGreen value: (button value=1) asBit
      ] repeat
    ] forkNamed: 'button'.
buttonProcess terminate.
buttonProcess isTerminated.
```

Pin table shows live pin state



Now when the button is pressed the green led is on

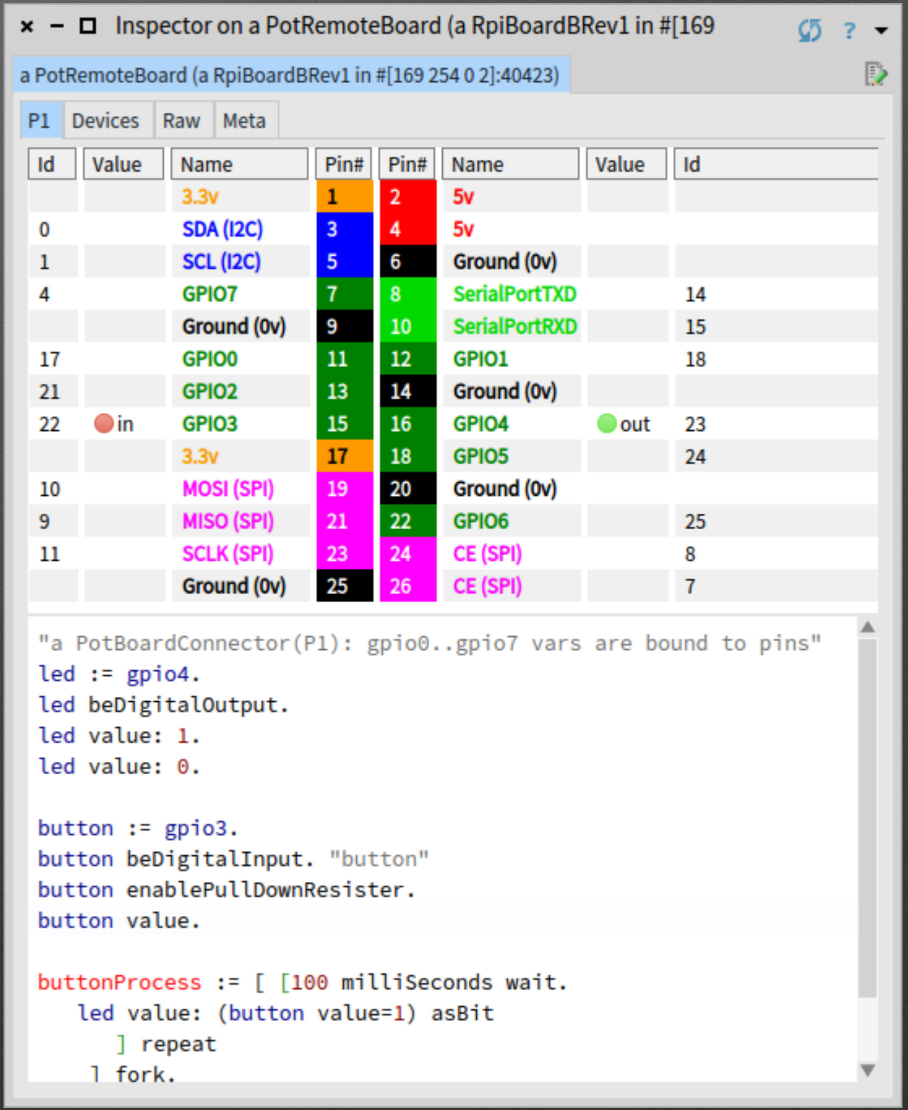
You can update the tools to your needs



```
Point
```

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
```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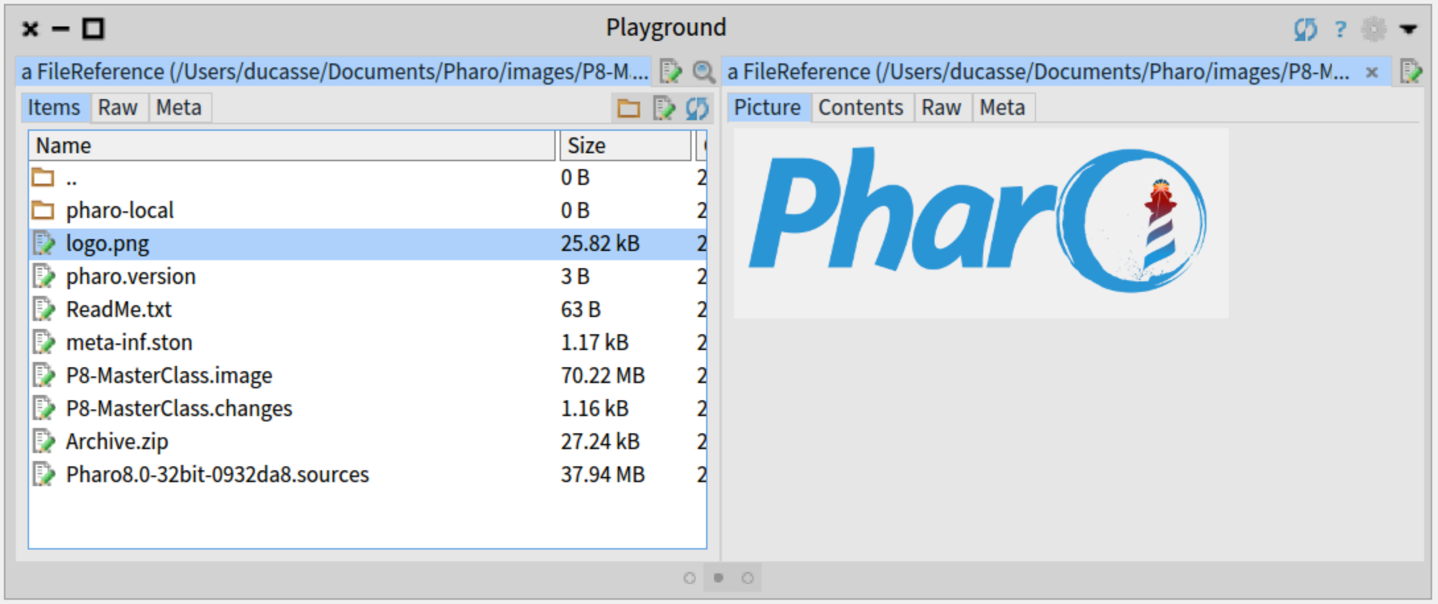
button beDigitalInput. "button"
button enablePullDownResister.
button value.

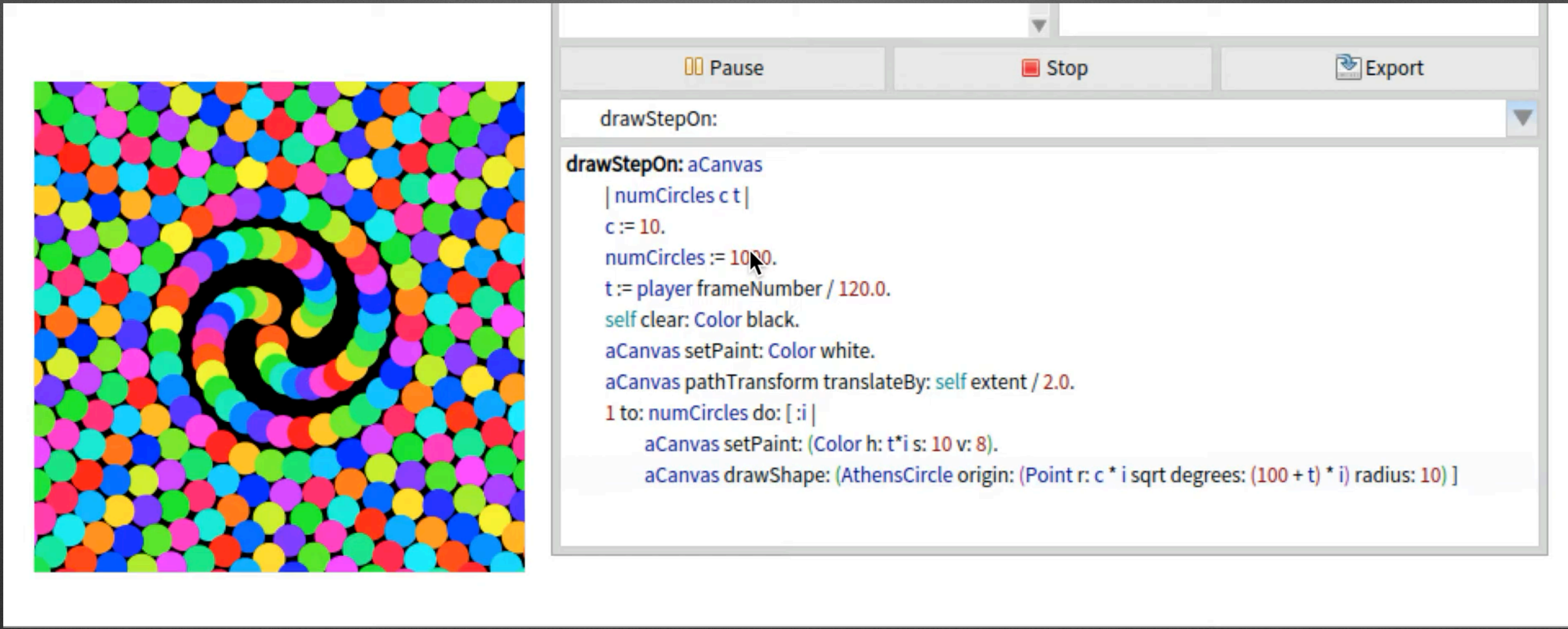
buttonProcess := [ [100 milliSeconds wait.
   led value: (button value=1) asBit
      ] repeat
    ] fork.
```


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
Pharo

Name	Size	
..	0 B	2
pharo-local	0 B	2
logo.png	25.82 kB	2
pharo.version	3 B	2
ReadMe.txt	63 B	2
meta-inf.ston	1.17 kB	2
P8-MasterClass.image	70.22 MB	2
P8-MasterClass.changes	1.16 kB	2
Archive.zip	27.24 kB	2
Pharo8.0-32bit-0932da8.sources	37.94 MB	2

Live Trying

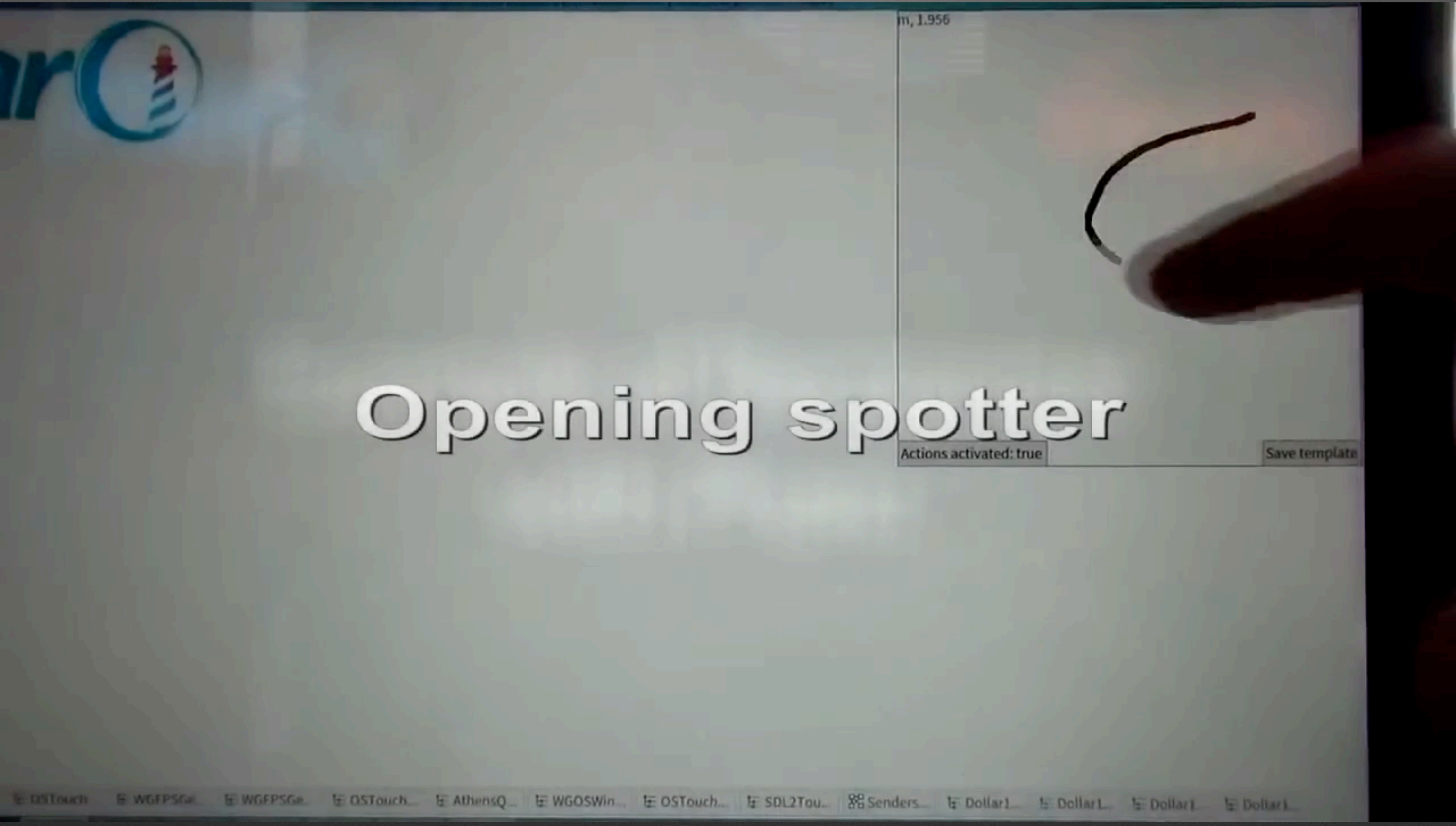
Life trying



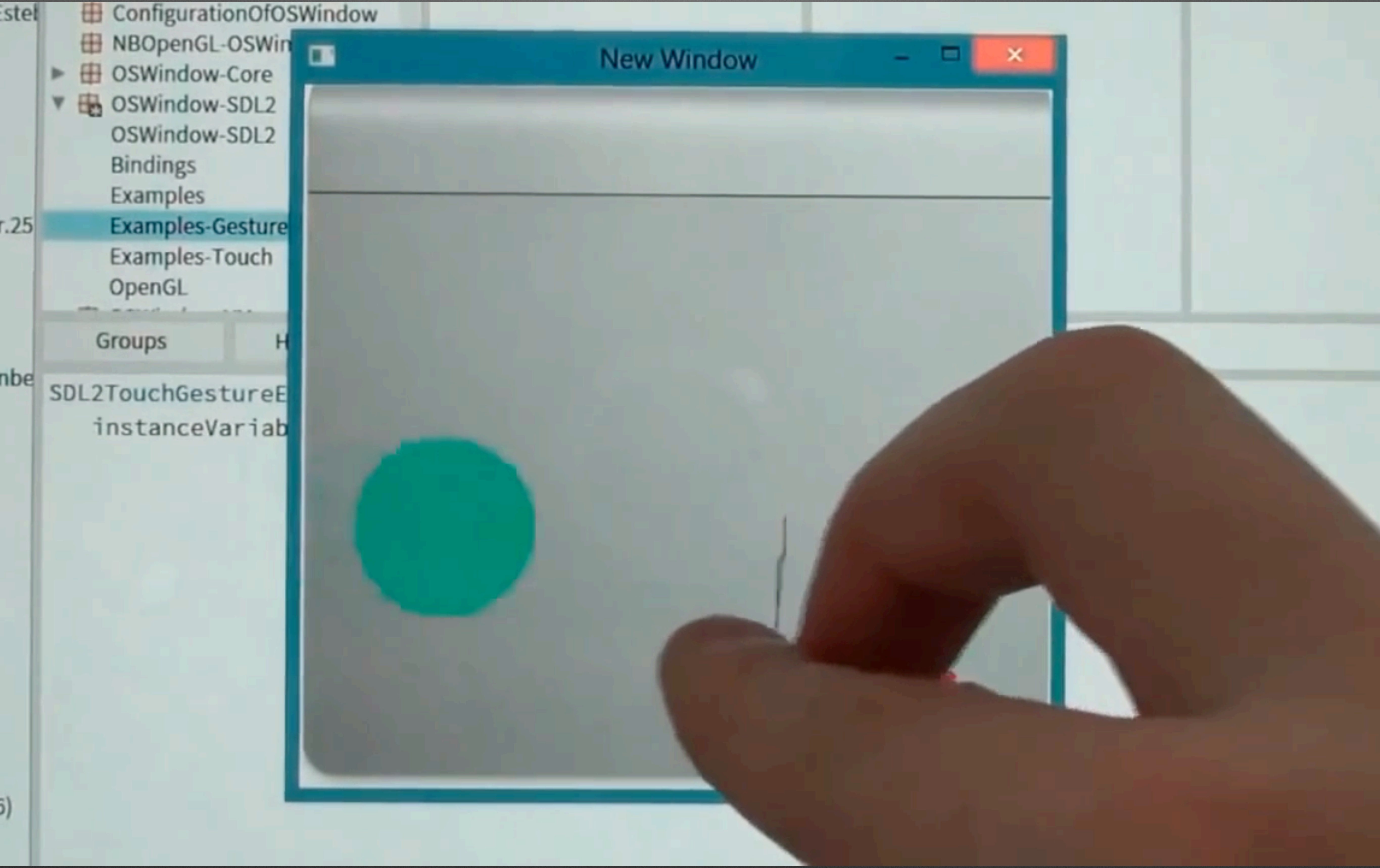
```
drawStepOn: aCanvas
    | numCircles c t |
    c := 10.
    numCircles := 1000.
    t := player frameNumber / 120.0.
    self clear: Color black.
    aCanvas setPaint: Color white.
    aCanvas pathTransform translateBy: self extent / 2.0.
    1 to: numCircles do: [ :i |
        aCanvas setPaint: (Color h: t*i s: 10 v: 8).
        aCanvas drawShape: (AthensCircle origin: (Point r: c * i sqrt degrees: (100 + t) * i) radius: 10) ]
```

Live Interaction

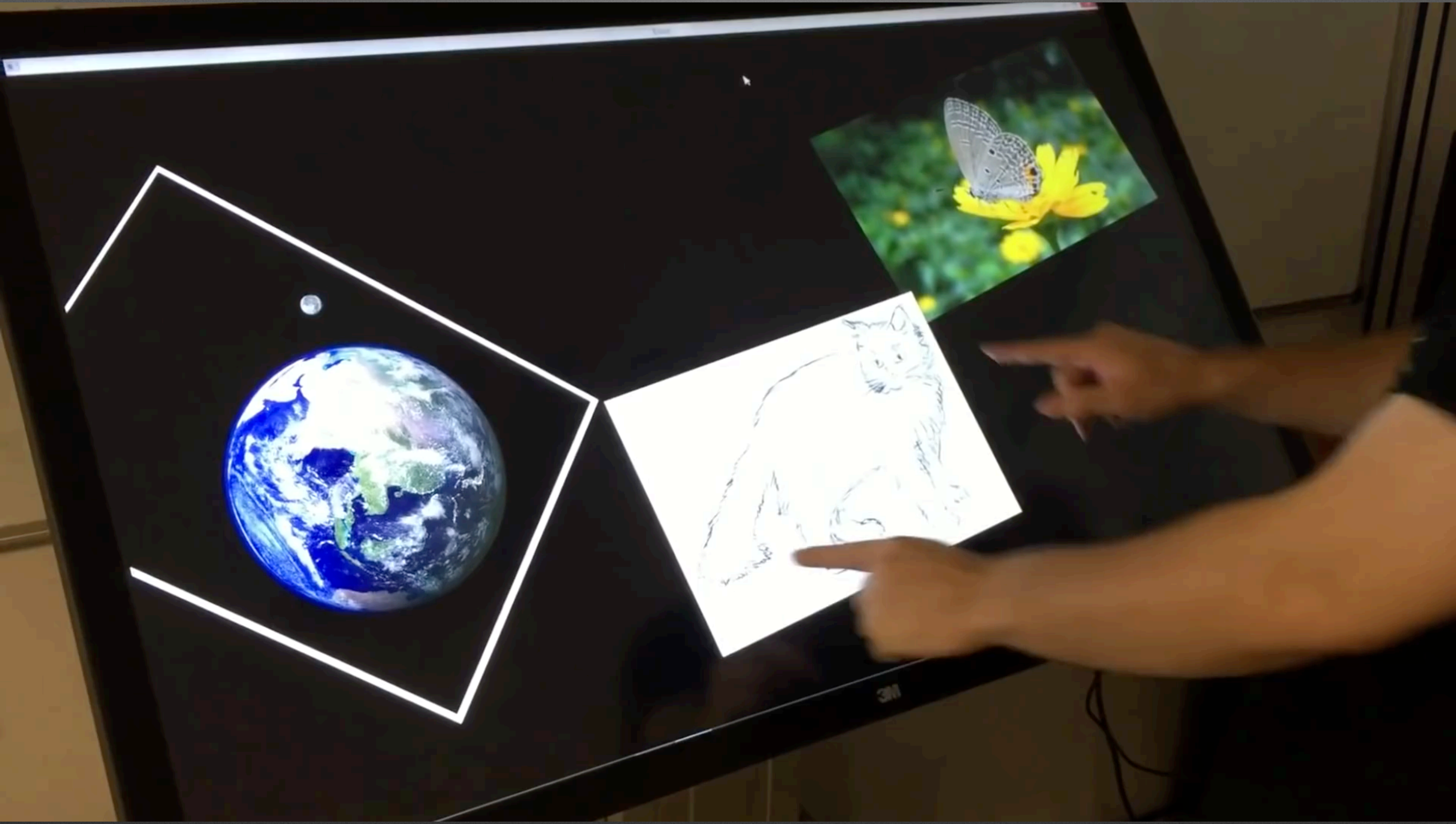
Gesture Recognition



Opening spotter



```
SDL2TouchGestureE
    instanceVariab
```



Live Visualization

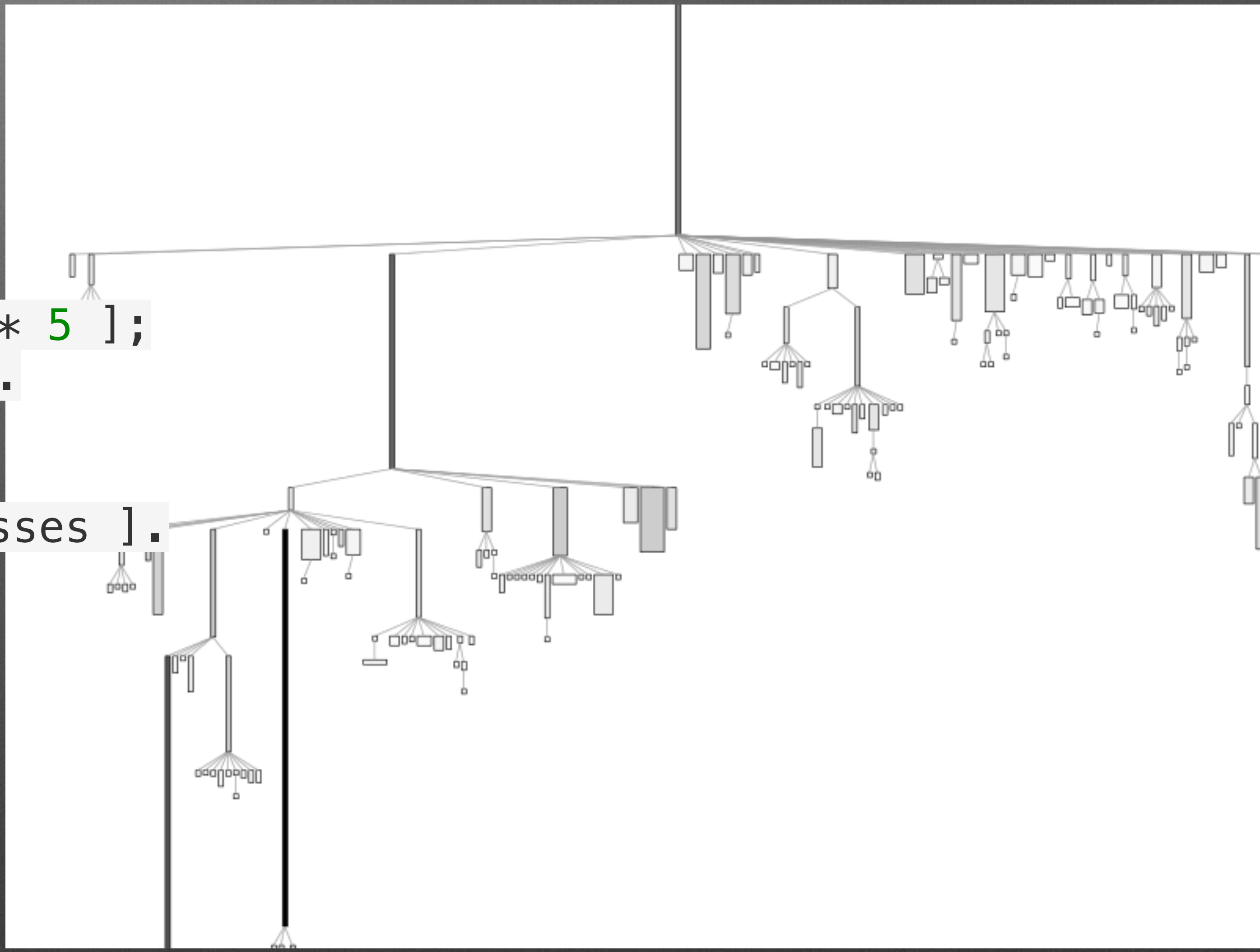
Live visualisation scripting

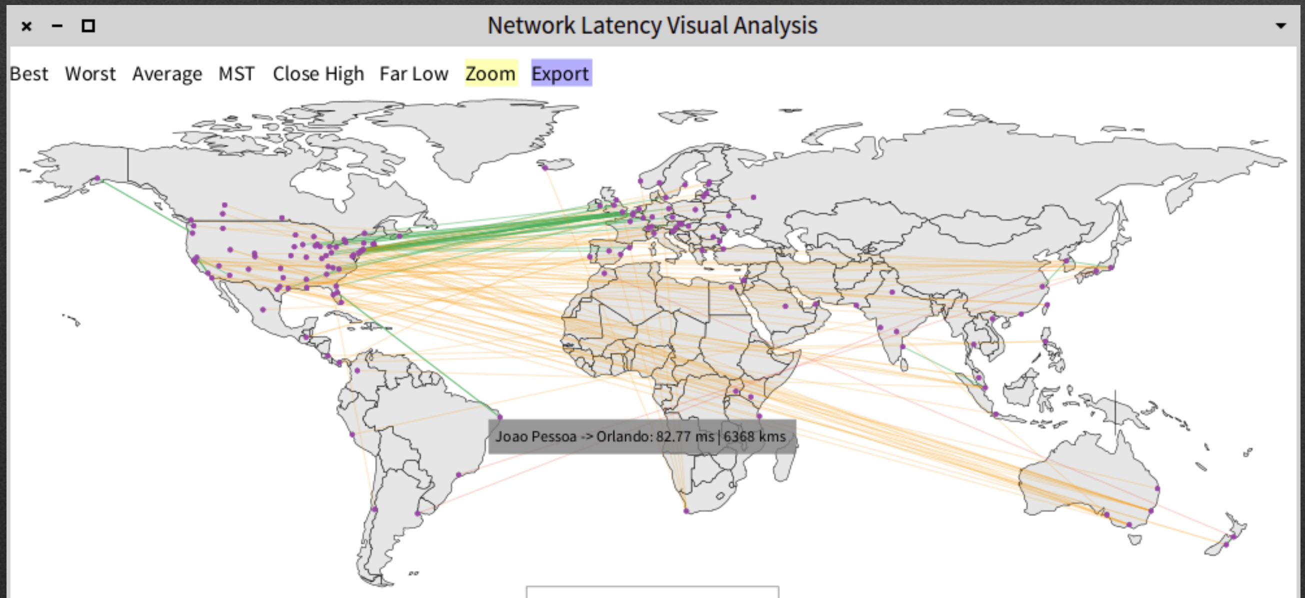
- The next level
- Roassal 3.0 by Prof. A. Bergel
- Simply gorgeous
- Check http://agilevisualization.com

Includes a DSL for Scripting visualisations

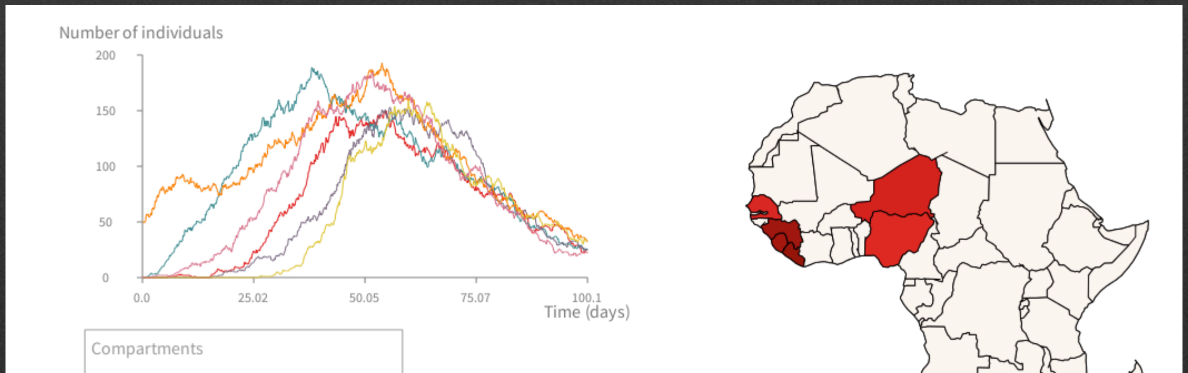
```
b := RTMondrian new.
    b shape rectangle
        withBorder;
        width: [ :cls | cls numberOfVariables * 5 ];
        height: [ :cls | cls numberOfMethods ].

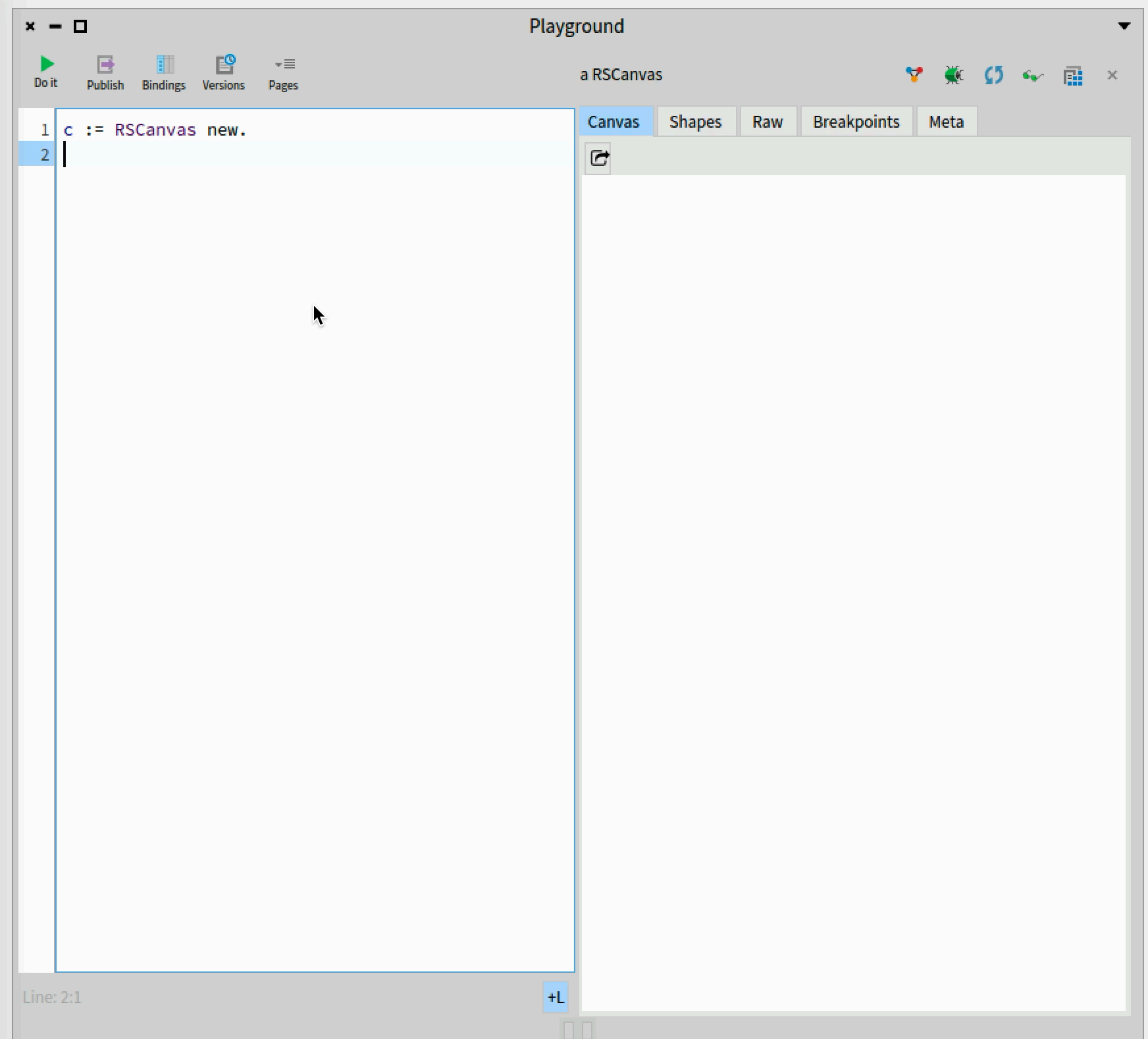
    b nodes: Collection withAllSubclasses.
    b edges connectToAll: [ :cls | cls subclasses ].
    b layout tree.
    b normalizer
        normalizeColorAsGray: [ :cls |
cls numberOfLinesOfCode ].
    b
```





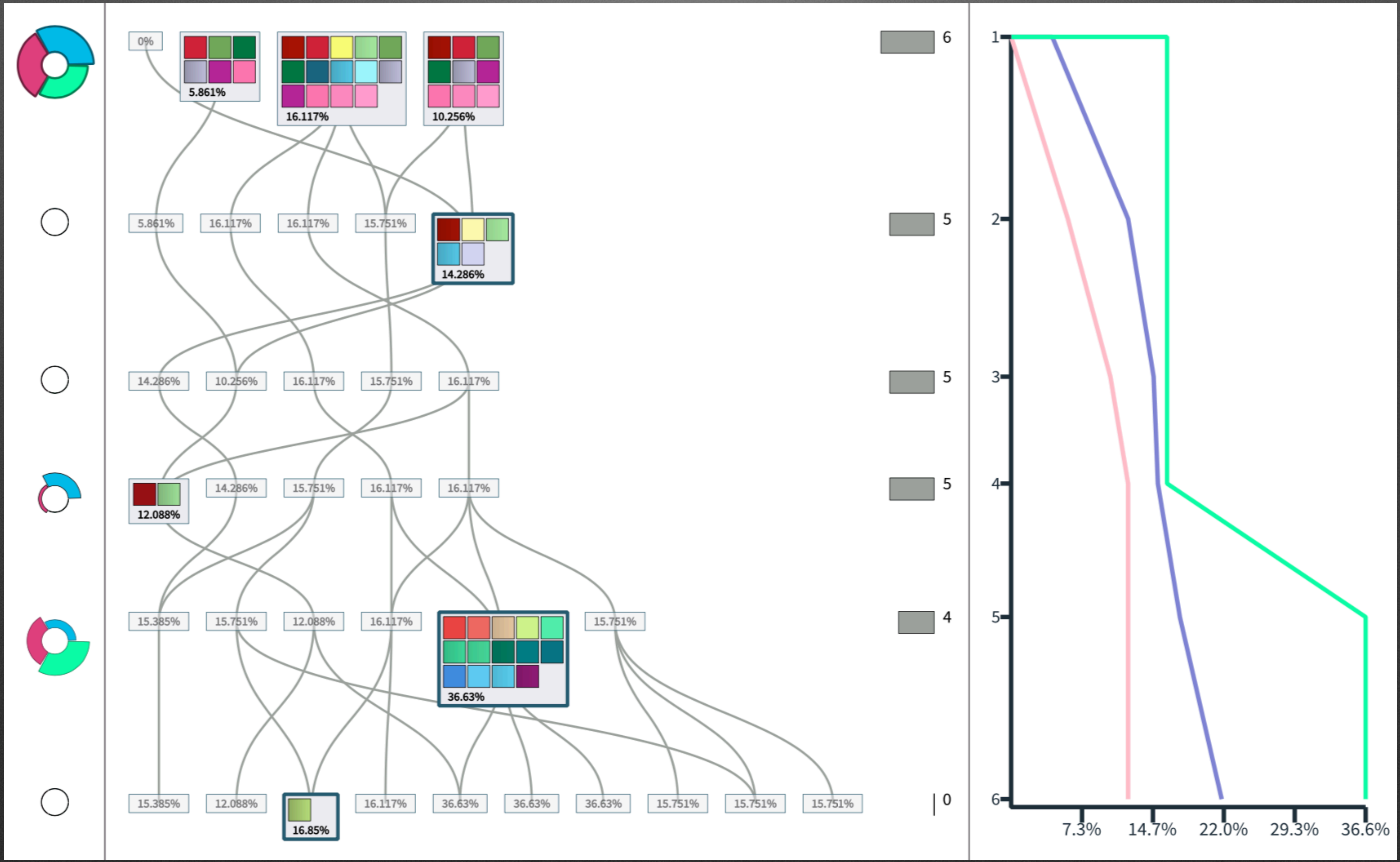
Network Latency Visual Analysis
Best
Worst
Average
MST
Close High
Far Low
Zoom
Export
Joao Pessoa -> Orlando: 82.77 ms | 6368 kms



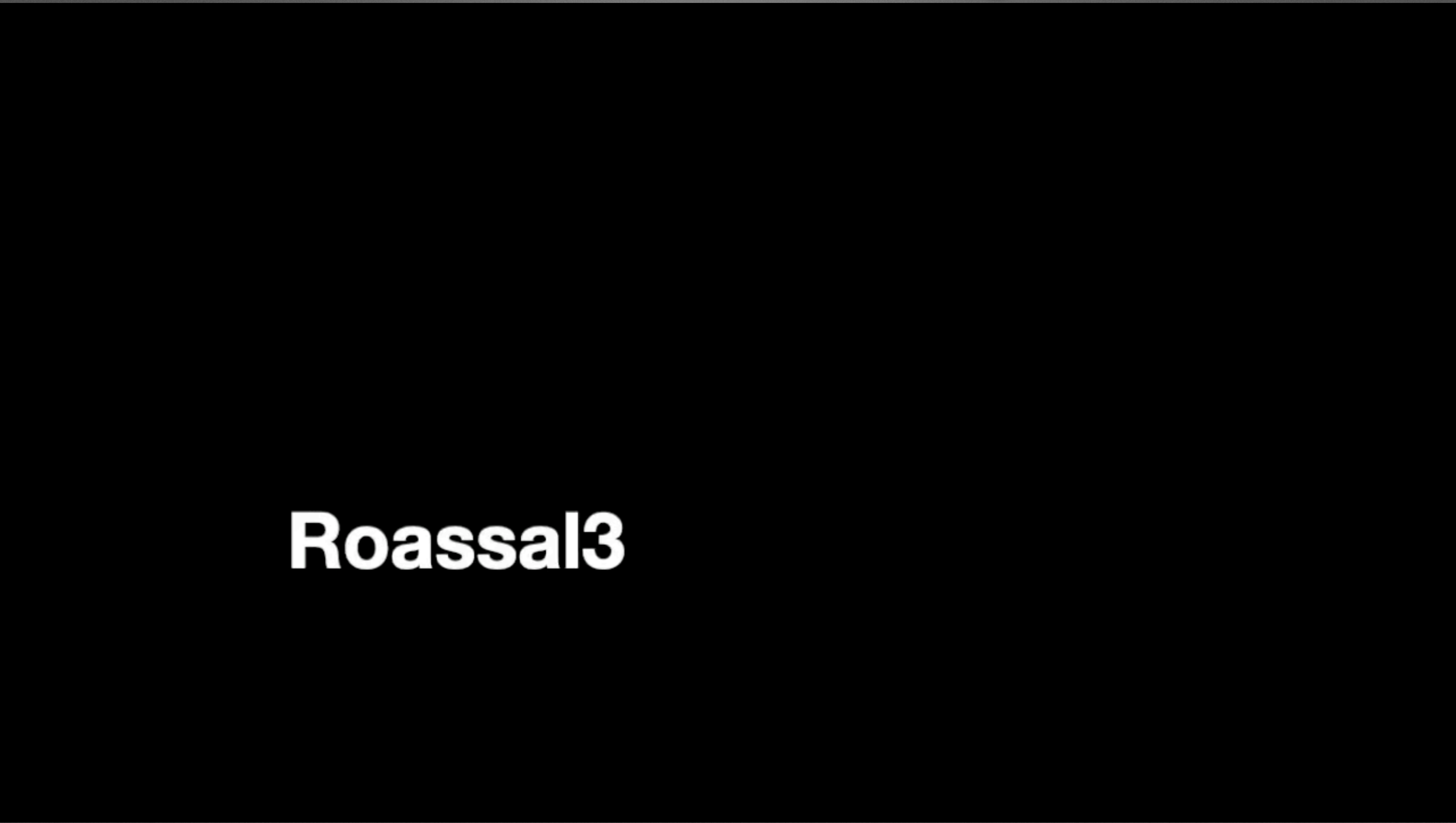


```
c := RSCanvas new.
```

Execution of IA generating tests



Roassal: scripting visualization engine



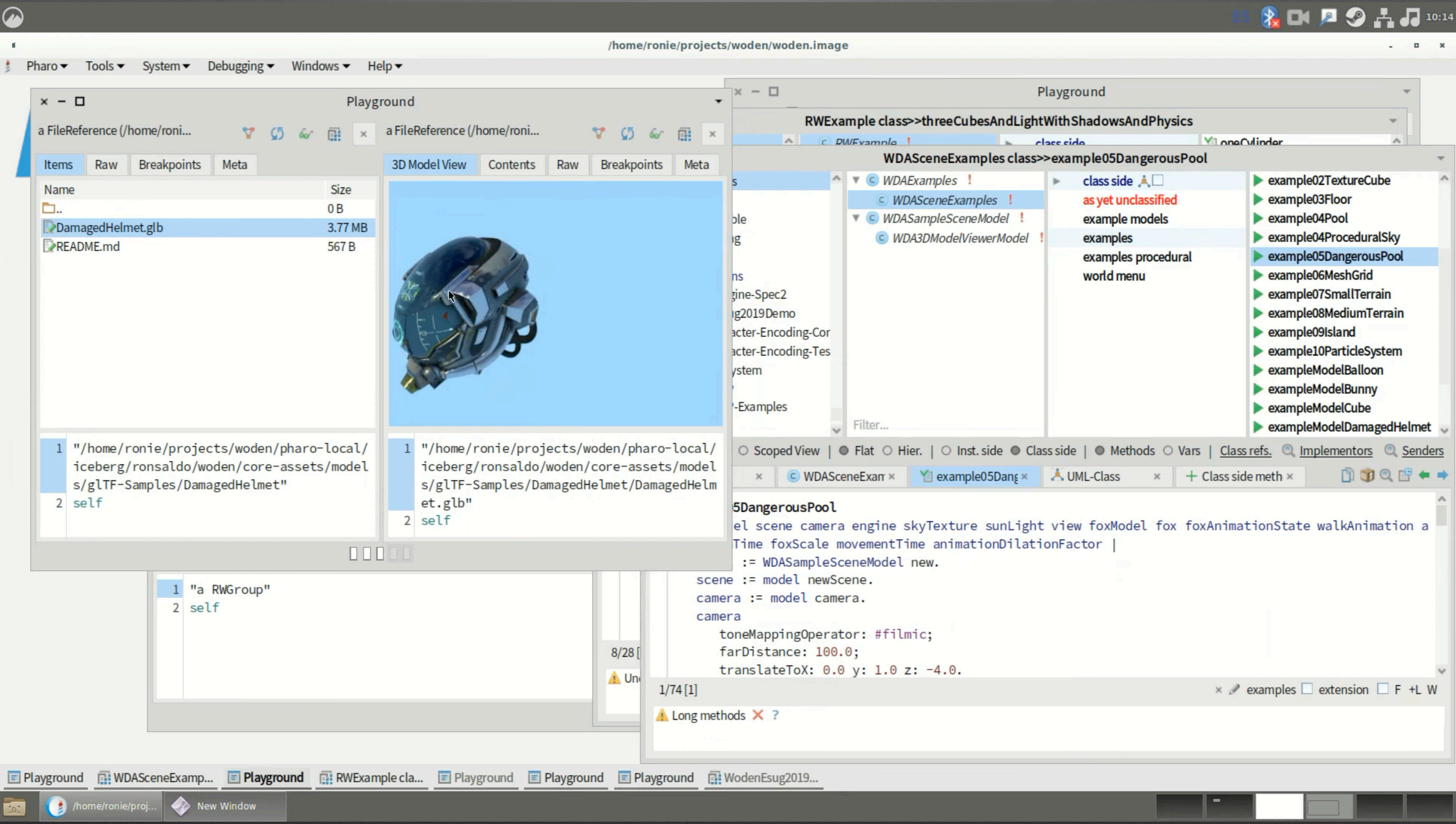
Roassal3

Live 3D and VR

Virtual Reality Live at Thales with Pharo

P. Laborde
E. Lepors
M. Ouddane

Live 3D scripting



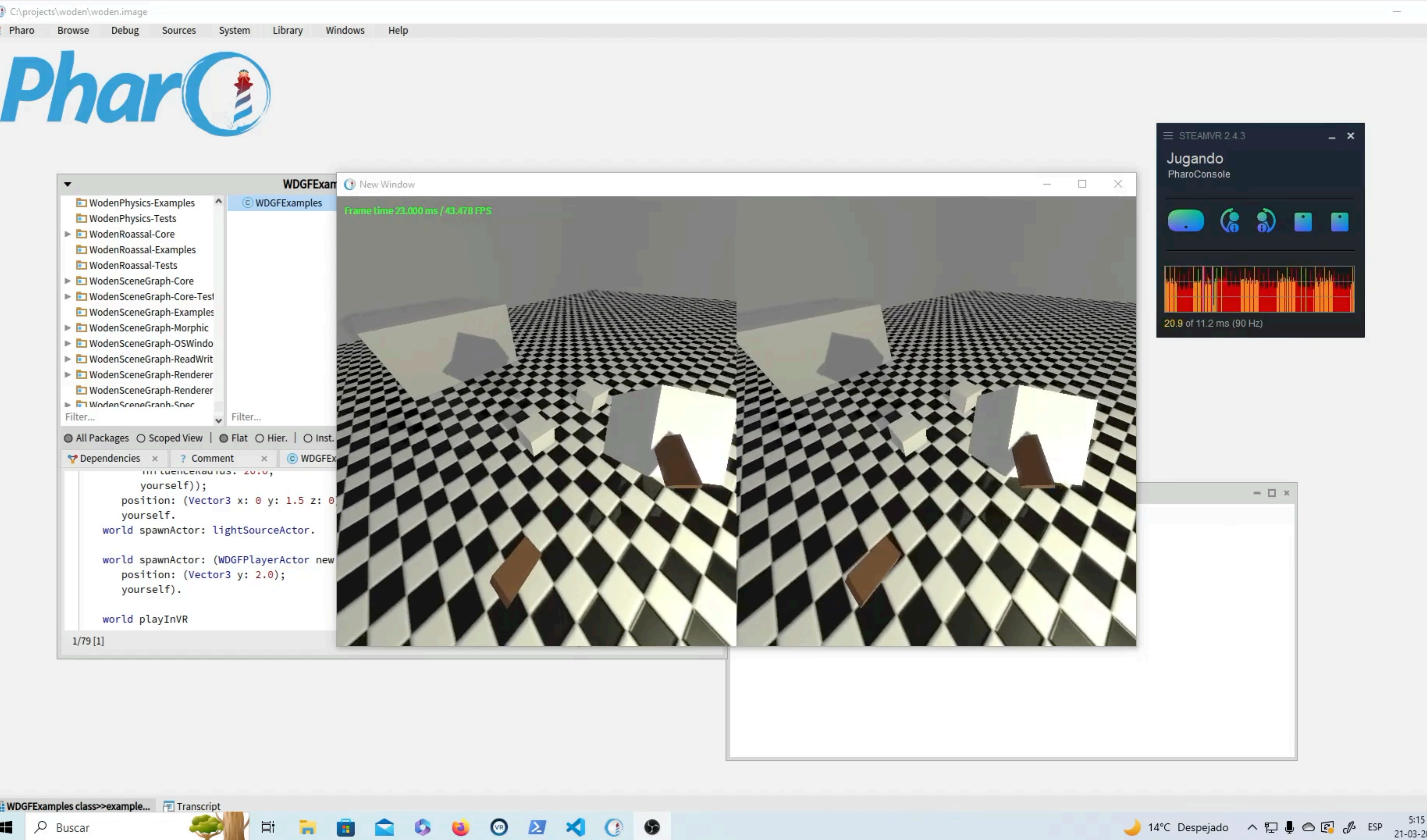
```
"/home/ronie/projects/woden/pharo-local/iceberg/ronsaldo/woden/core-assets/models/glTF-Samples/DamagedHelmet"
self
```

```
"/home/ronie/projects/woden/pharo-local/iceberg/ronsaldo/woden/core-assets/models/glTF-Samples/DamagedHelmet/DamagedHelmet.glb"
self
```

```
"a RWGroup"
self
```

```
5DangerousPool
el scene camera engine skyTexture sunLight view foxModel fox foxAnimationState walkAnimation a
Time foxScale movementTime animationDilationFactor |
 := WDASampleSceneModel new.
scene := model newScene.
camera := model camera.
camera
   toneMappingOperator: #filmic;
   farDistance: 100.0;
   translateToX: 0.0 y: 1.0 z: -4.0.
```

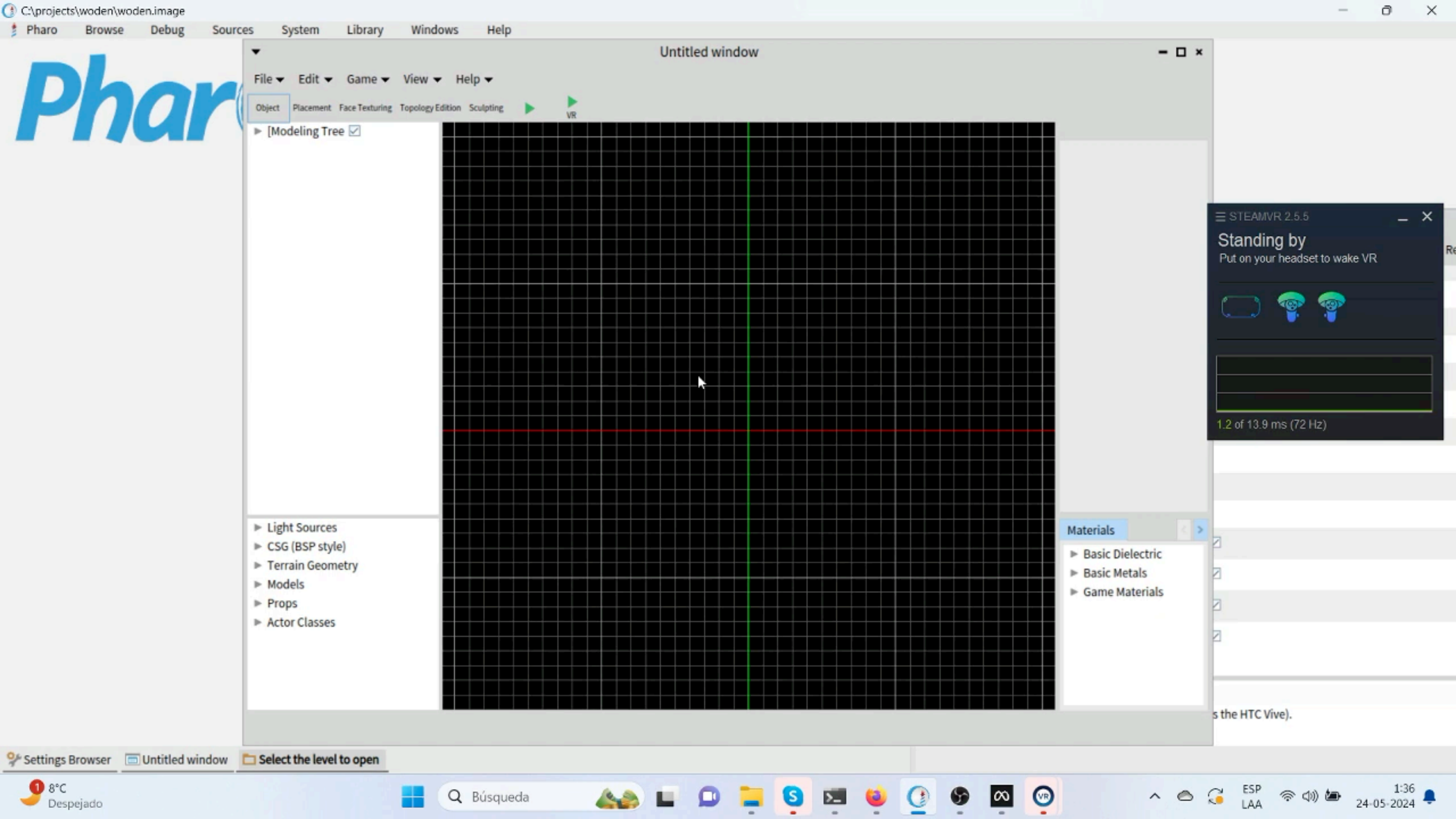
Enhanced VR



```
        influenceRadius: 20.0;
      yourself));
    position: (Vector3 x: 0 y: 1.5 z: 0
    yourself.
  world spawnActor: lightSourceActor.

  world spawnActor: (WDGFPlayerActor new
    position: (Vector3 y: 2.0);
    yourself).

  world playInVR
```



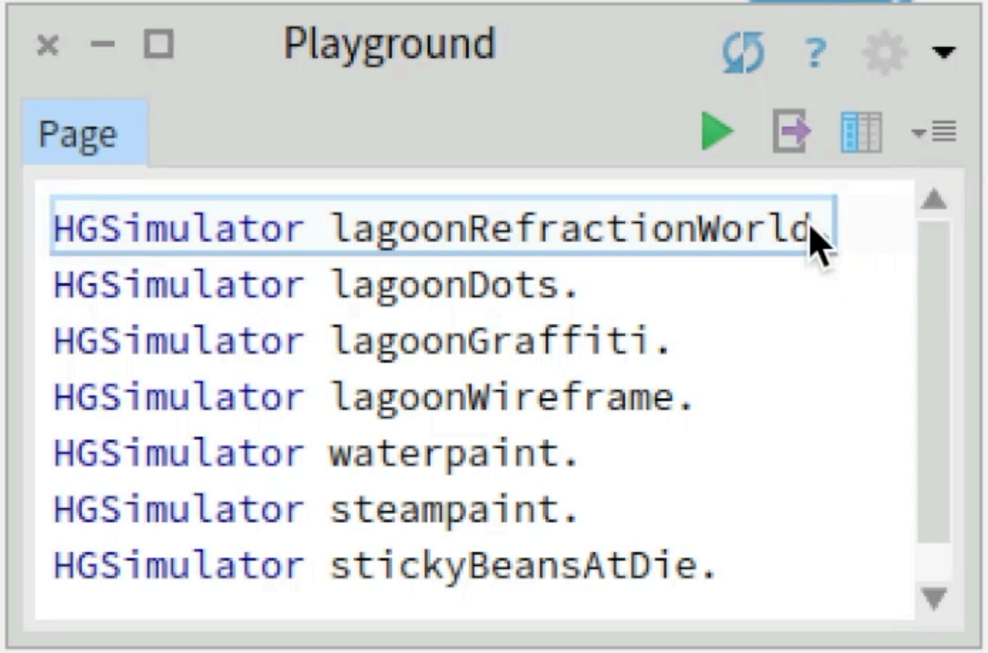
Standing by

Put on your headset to wake VR

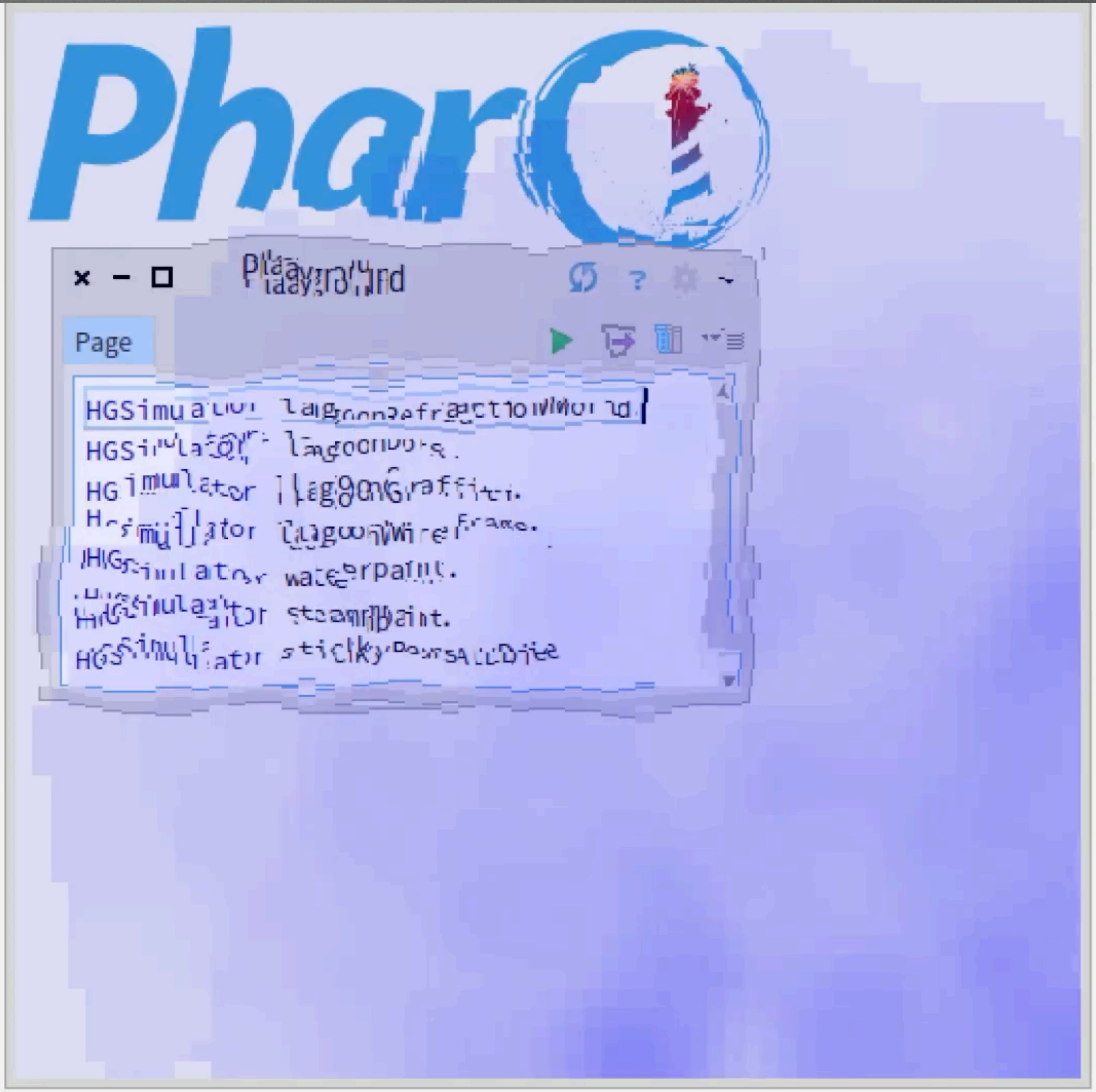
1.2 of 13.9 ms (72 Hz)

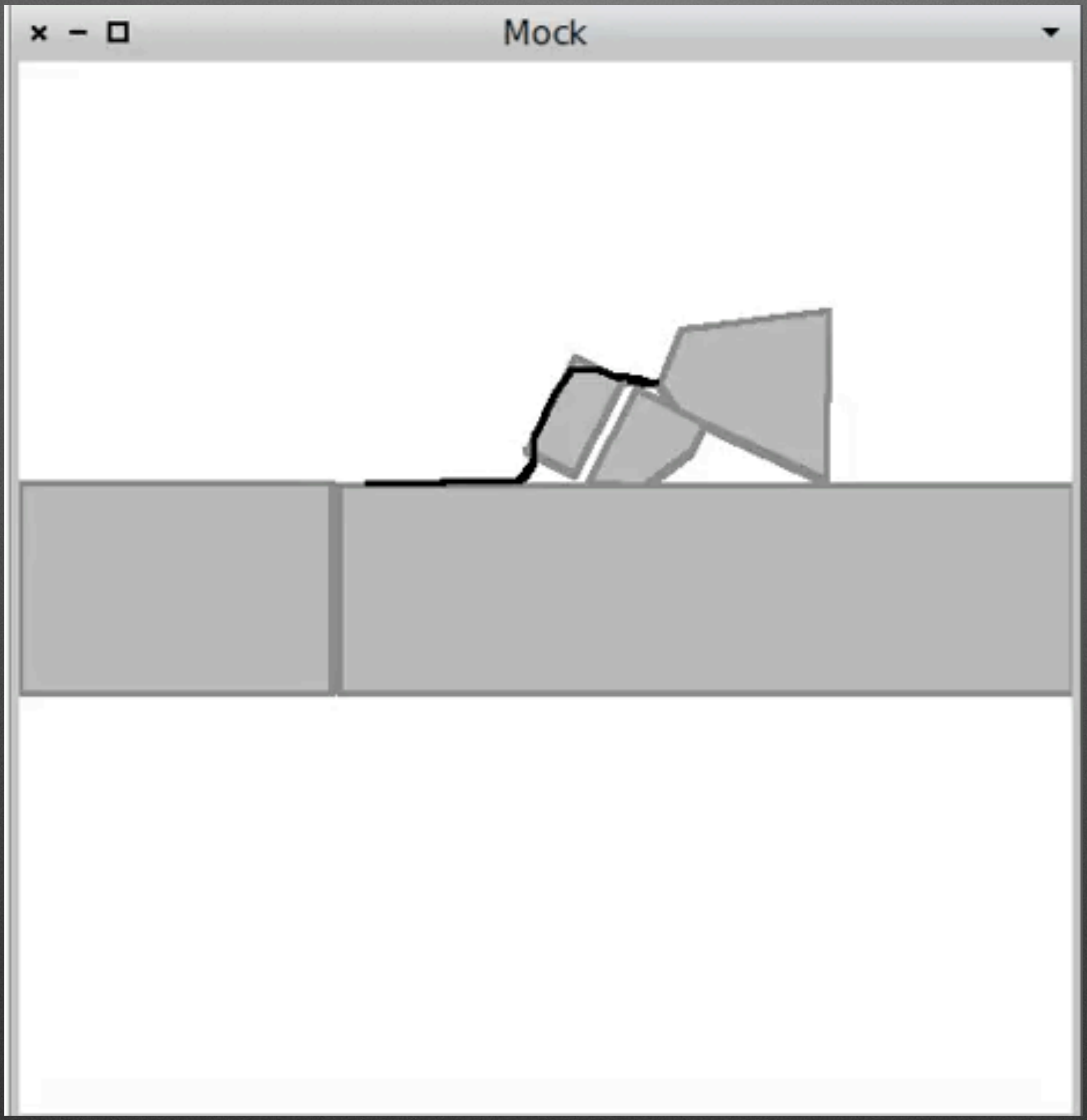
s the HTC Vive).

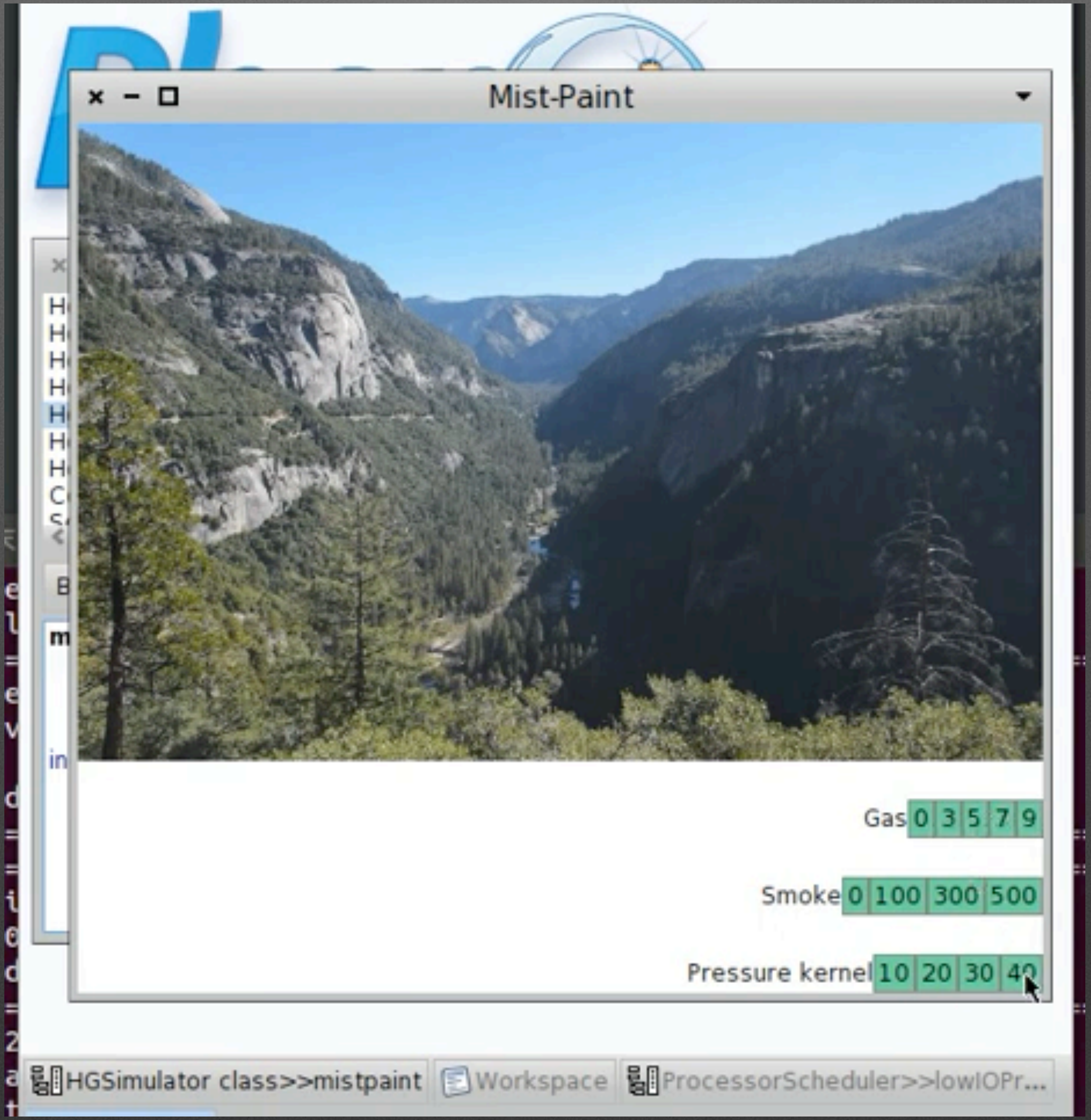
Mixing 2D and 3D with Honey Ginger particule system

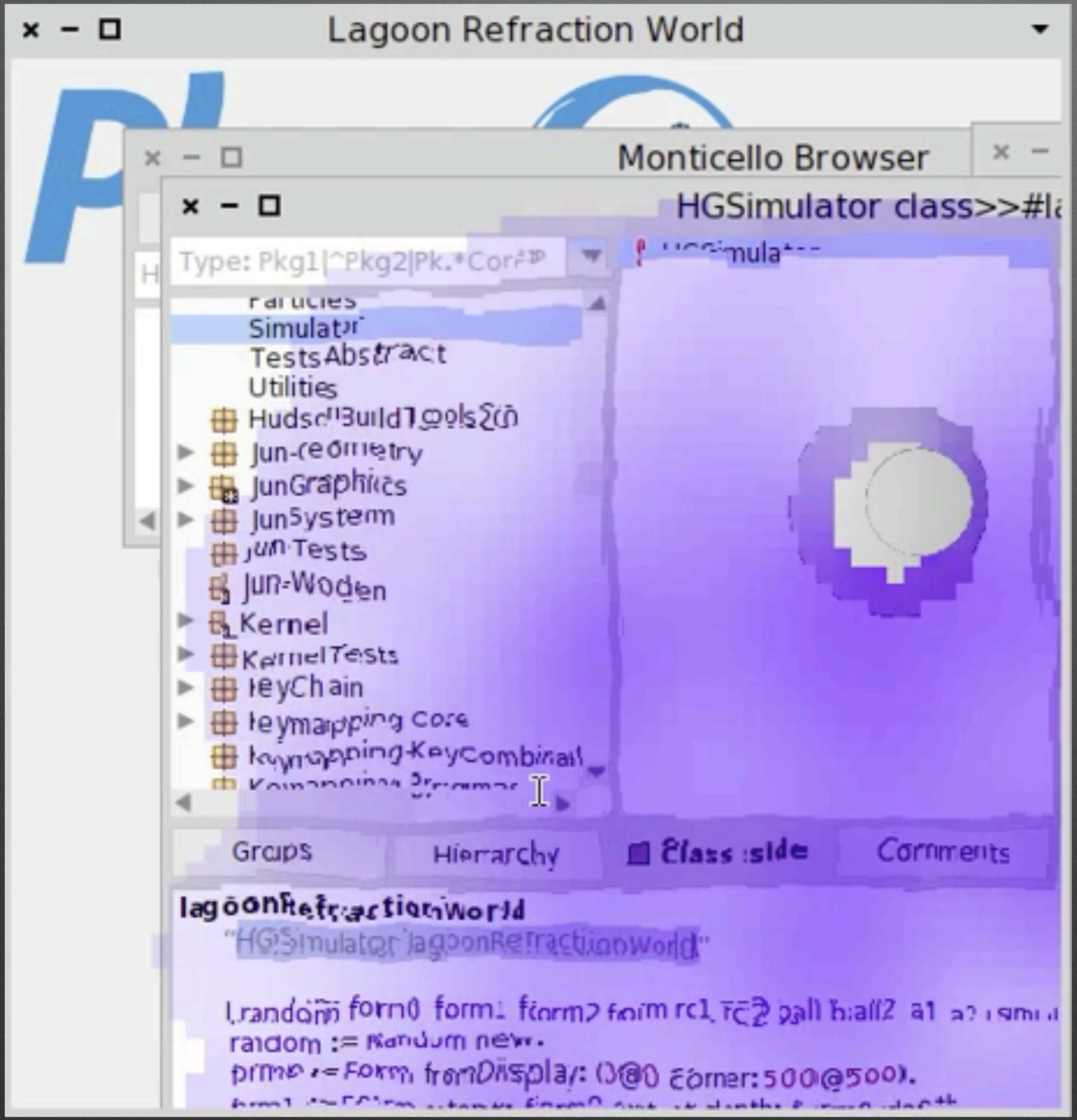


```
HGSimulator lagoonRefractionWorld
HGSimulator lagoonDots.
HGSimulator lagoonGraffiti.
HGSimulator lagoonWireframe.
HGSimulator waterpaint.
HGSimulator steampaint.
HGSimulator stickyBeansAtDie.
```




× − □
Mock
▾

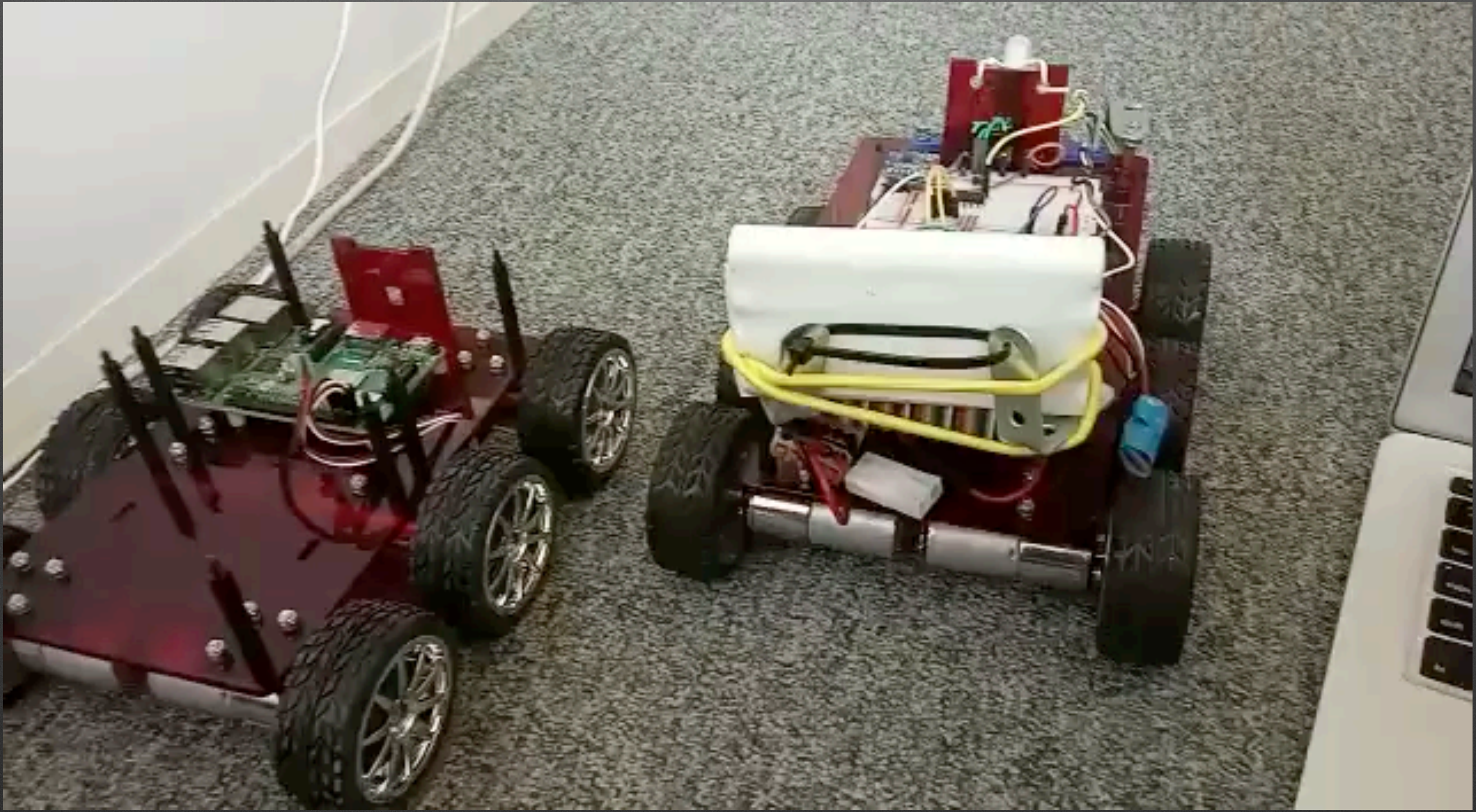

Mist-Paint
Gas 0 3 5 7 9
Smoke 0 100 300 500
Pressure kernel 10 20 30 40
HGSimulator class>>mistpaint
Workspace
ProcessorScheduler>>lowIOPr...



```
lagoonRefractionWorld
	"HGSimulator lagoonRefractionWorld"

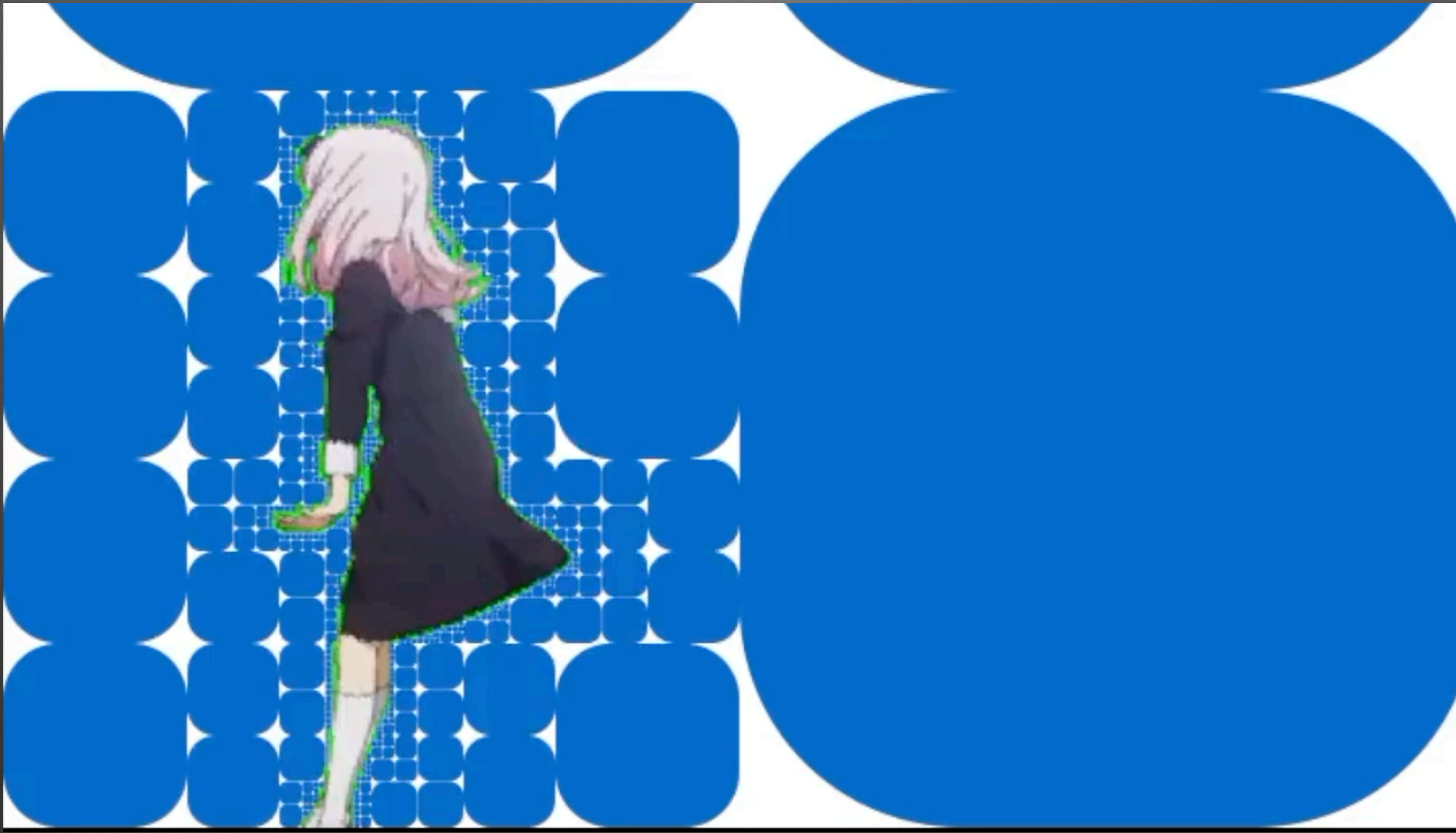
	| random form0 form1 form2 form rc1 rc2 ball ball2 a1 a2 simu
	random := Random new.
	prime := Form fromDisplay: (0@0 corner: 500@500).
```

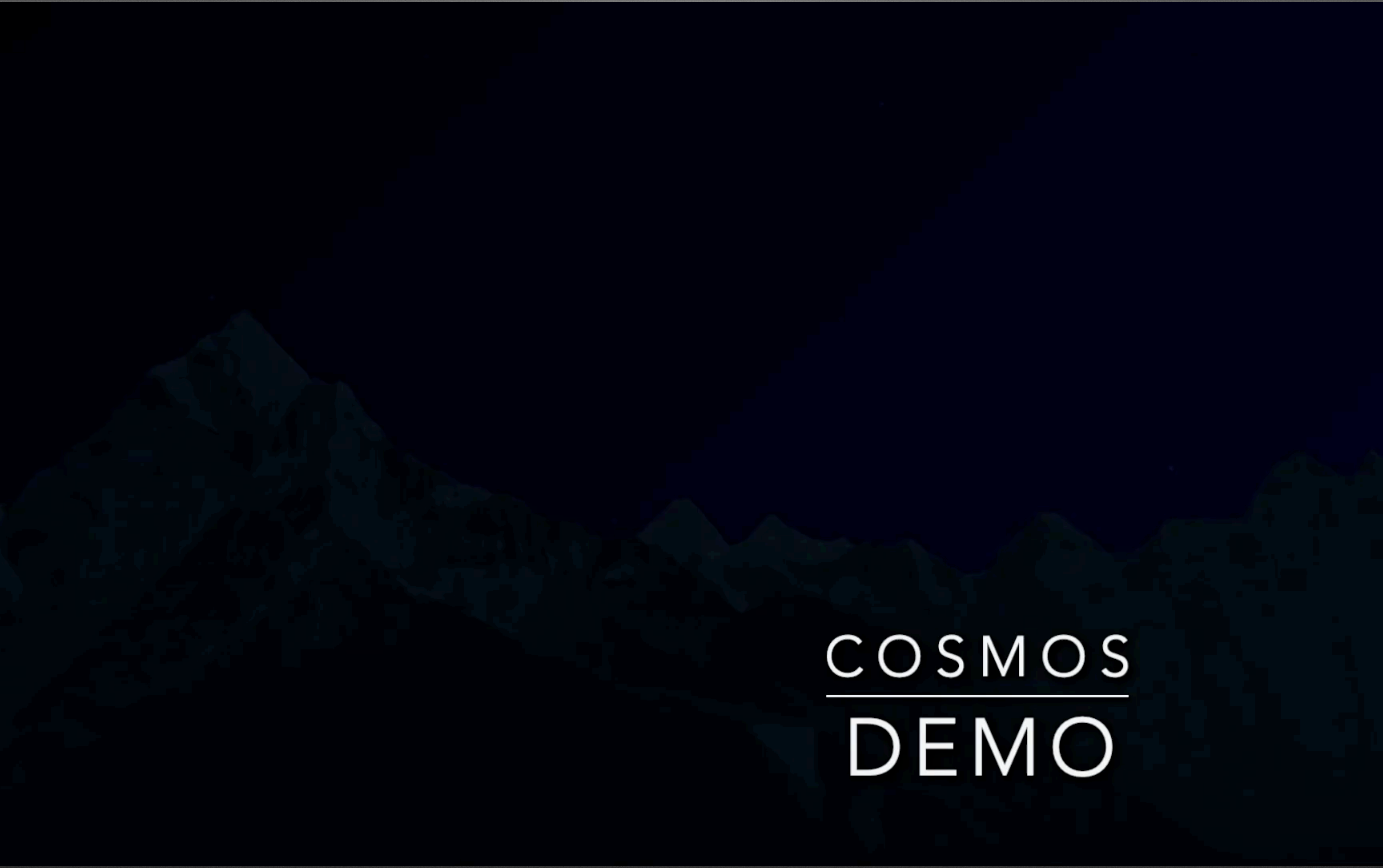
IOT



Art and Roassal

- Random - [Random](https://www.youtube.com/watch?v=R2rLr7Z1b8Y)
- Cosmos - [Cosmos](https://youtu.be/02erVntwIo8)
- Hex - [Hex](https://youtu.be/HpQD5QKmzTc)
- Miku - [Miku](https://youtu.be/_aZPZzSZ8XQ)
- Quadtree - [QuadTree](https://youtu.be/H8zedVWw5UA)
- Noises - [Noises](https://youtu.be/wKMFSNOmtNg)
- Eclipse - [Eclipse](https://youtu.be/6wHL0GtlJc8)





COSMOS

DEMO

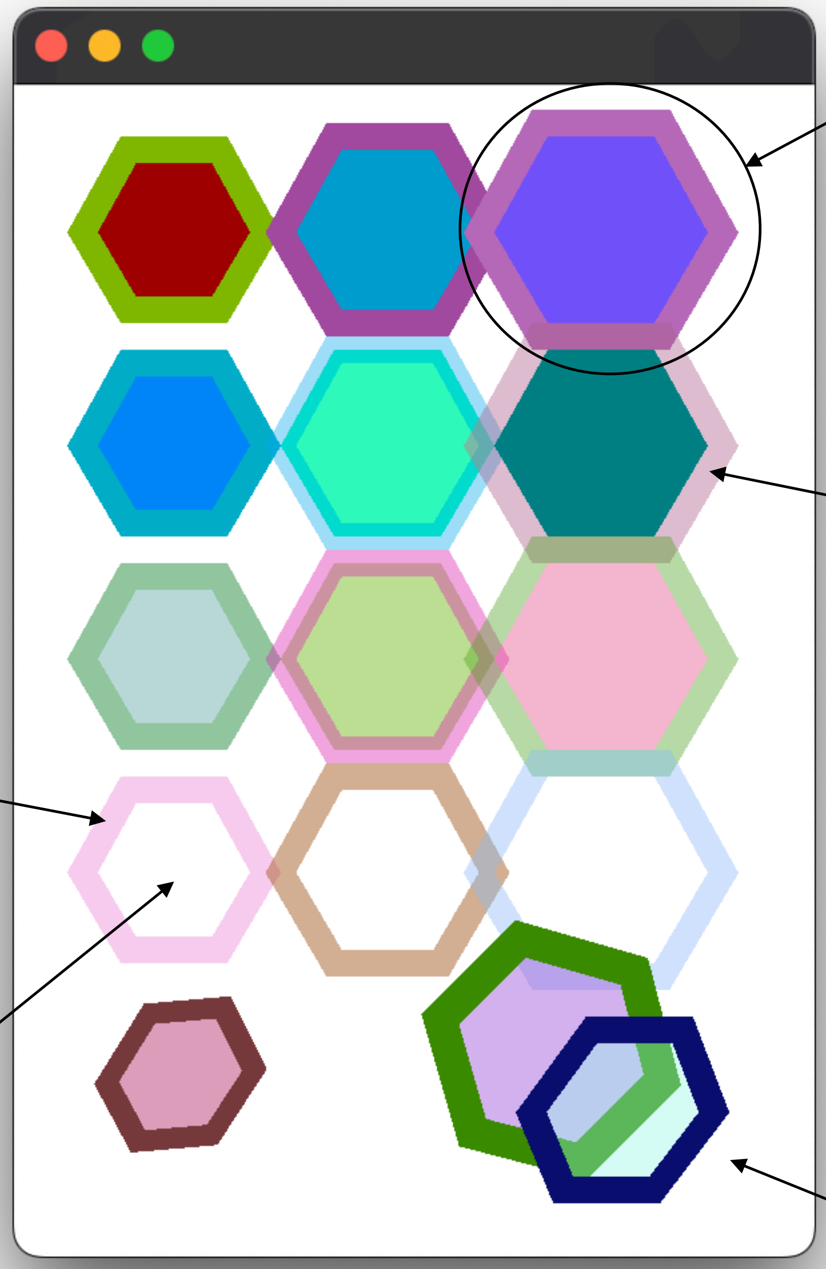
Pharo look :(

- Yes the Pharo look is dated :)
- We took 8 years and we are nearly there to fix it: Bloc/Toplo are coming

Bloc: New Generation Graphics

- Full new implementation of graphics framework
- Basis for Toplo: a new widget library based on http://ant.design design

Element's visual properties



a BlElement

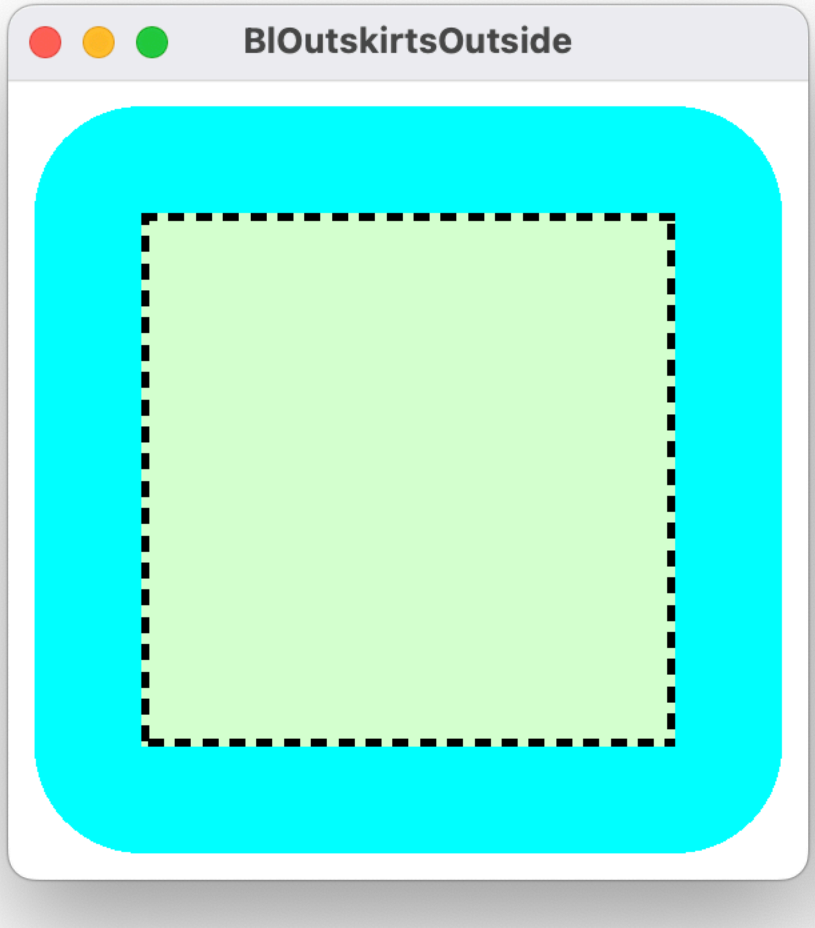
geometry
(polygon)

border

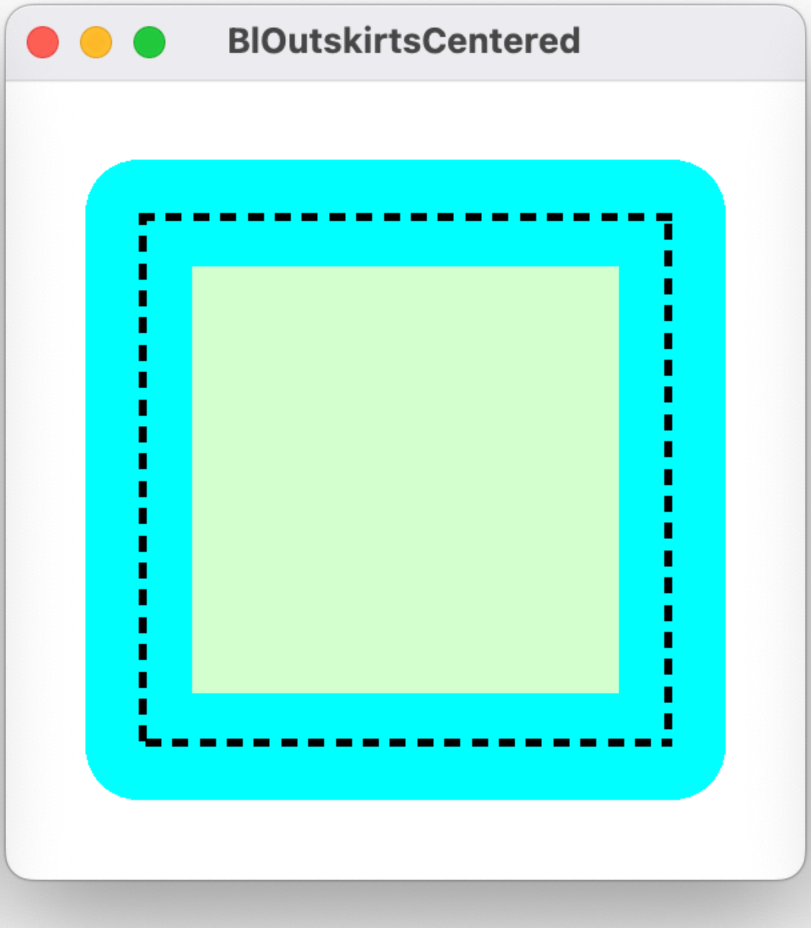
transformation
(a matrix with
skew and translation)

background

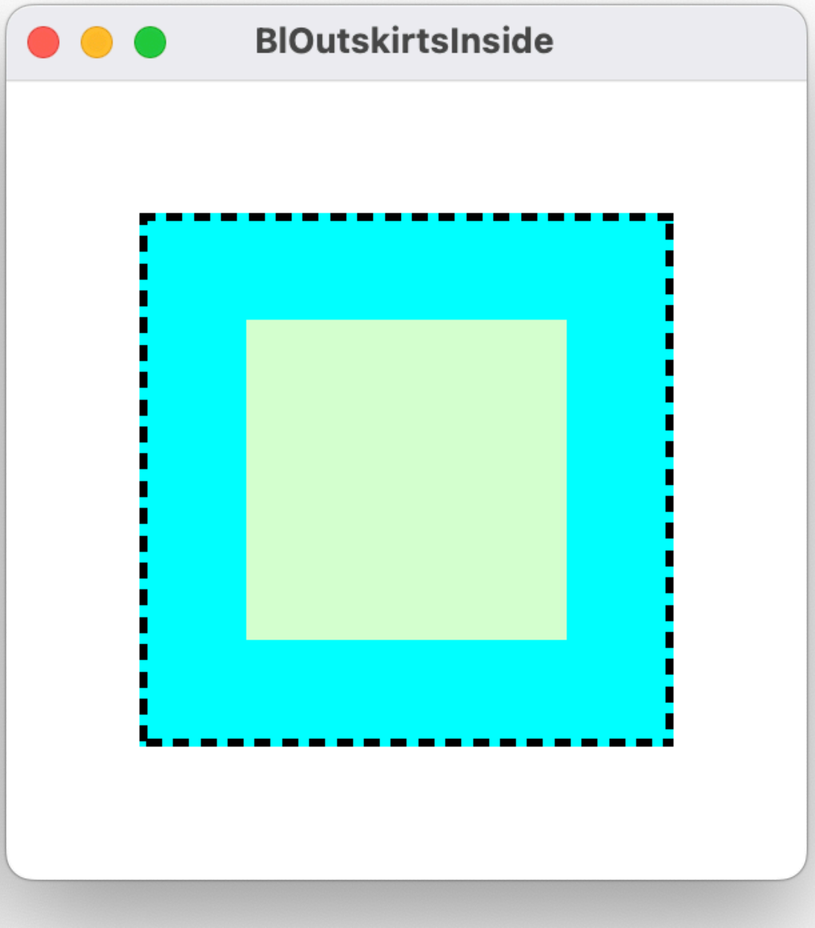
Element's outskirts



```
aBlElement
    outskirts:
        BlOutskirts outside
```

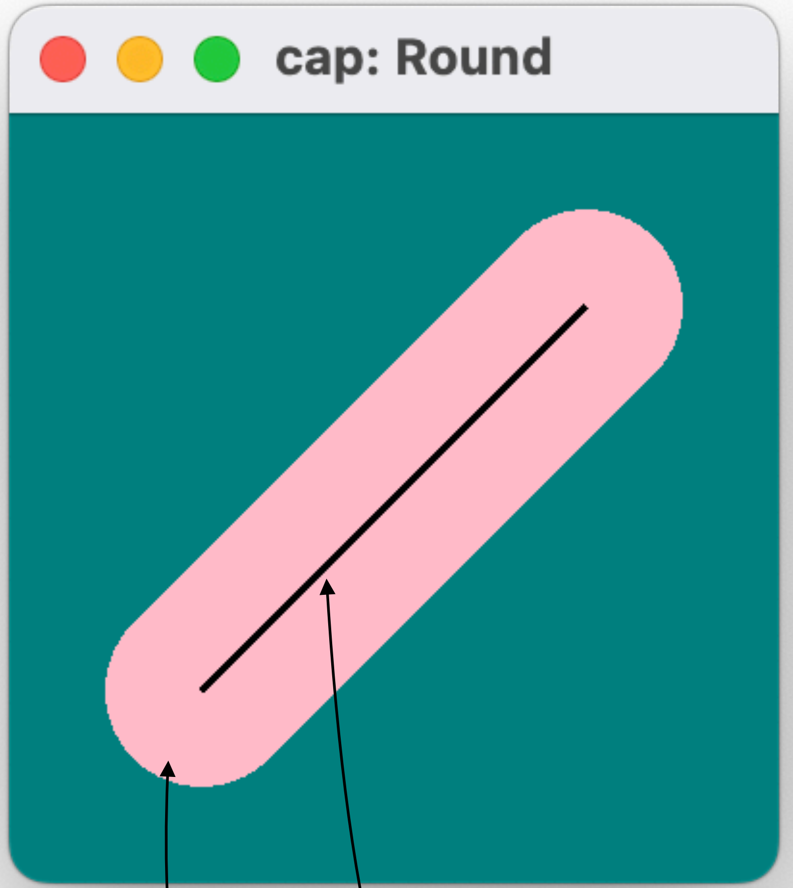


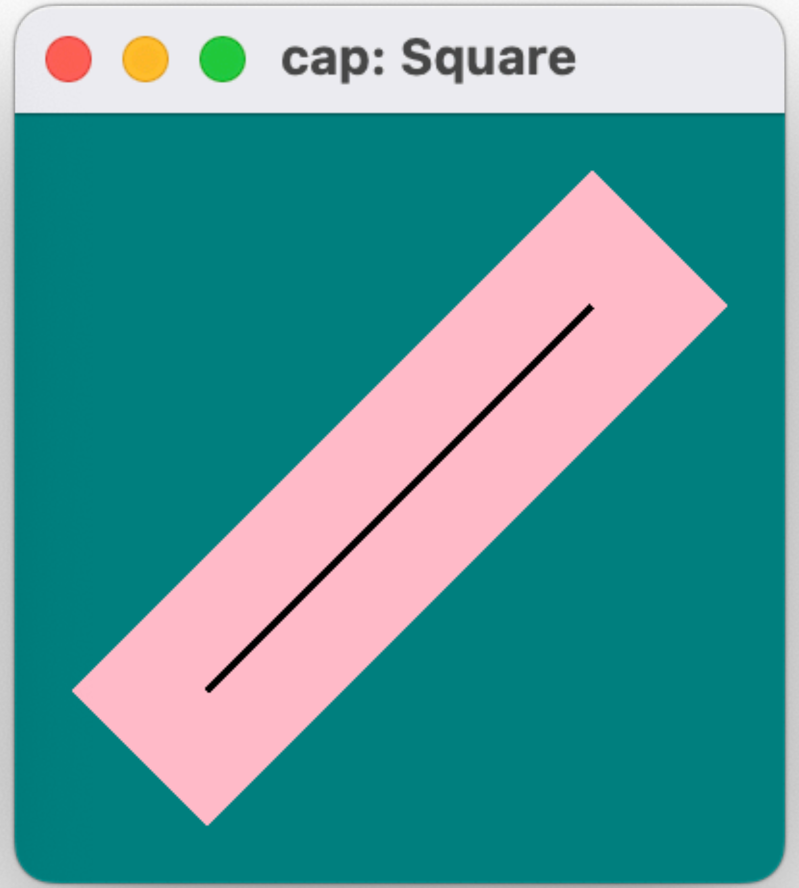
```
aBlElement
    outskirts:
        BlOutskirts centered
```

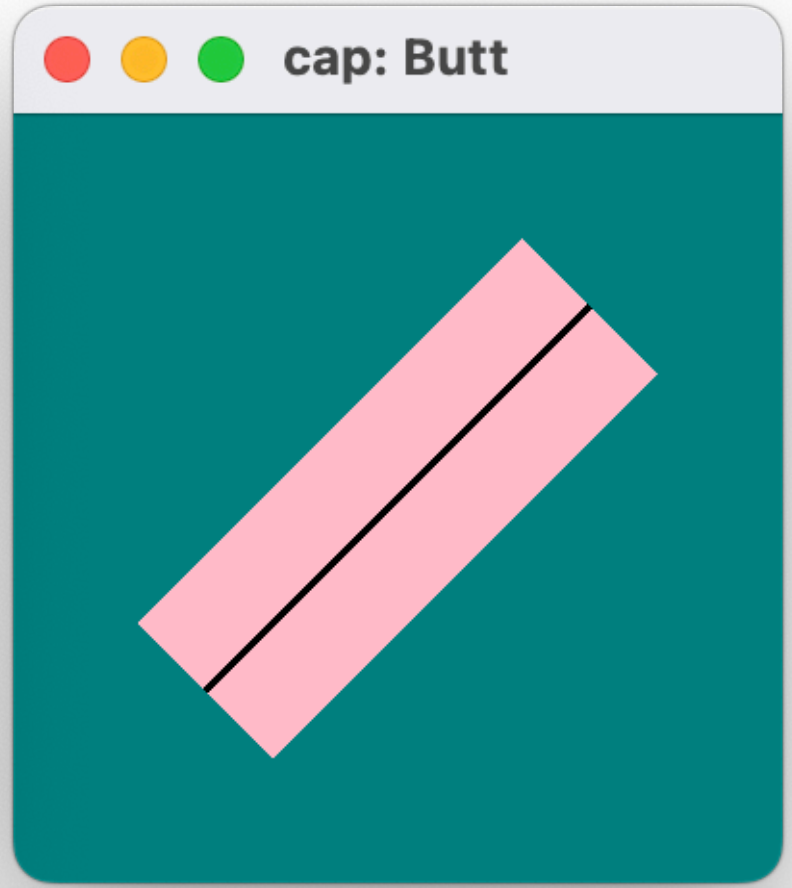


```
aBlElement
    outskirts:
        BlOutskirts inside
```

Border's cap





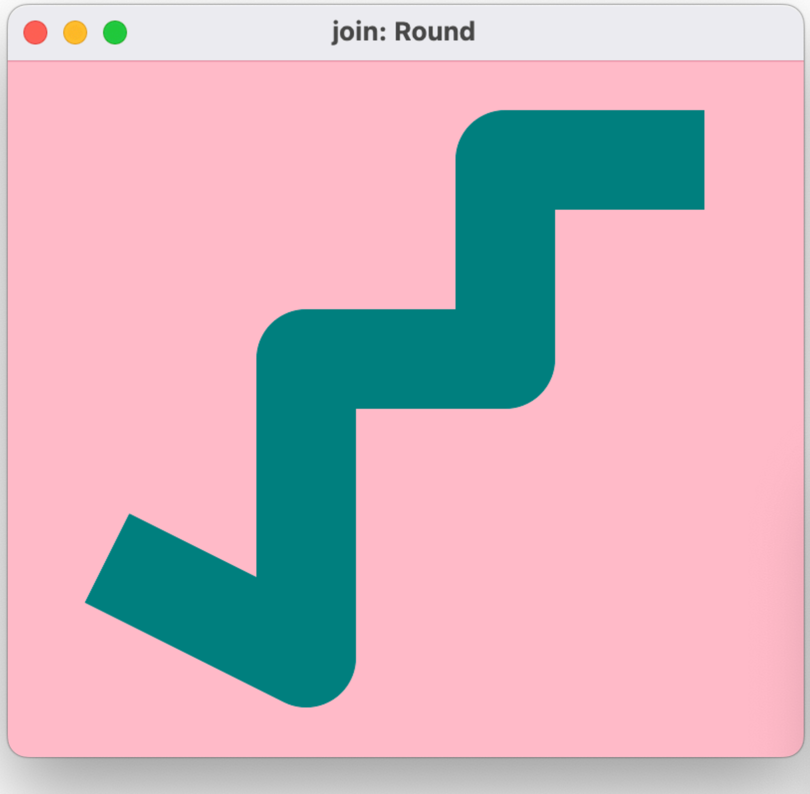


```
vertices := { 50@150. 150@50}.

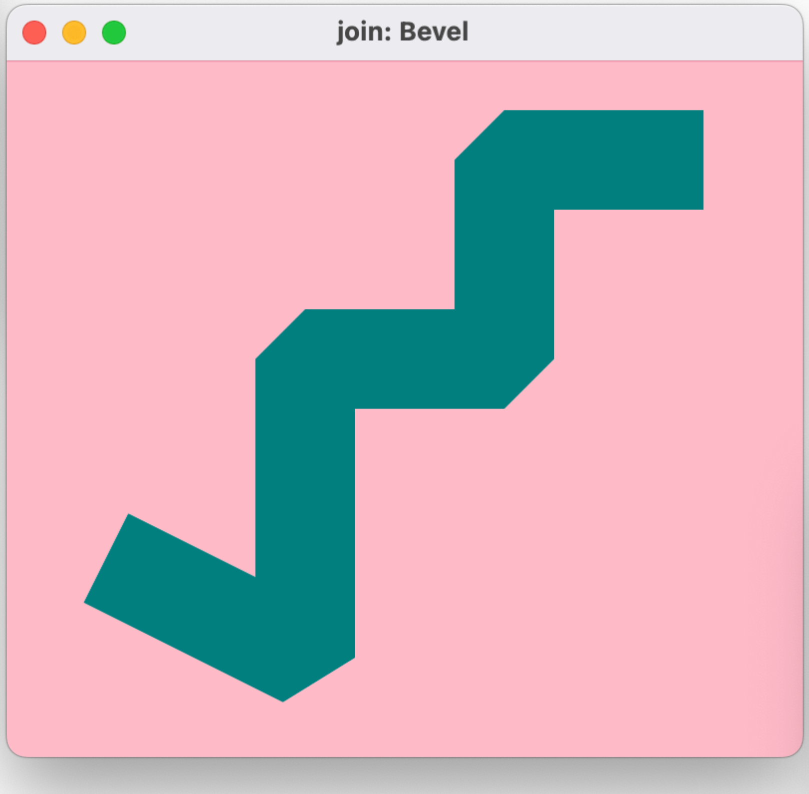
referenceLine := (BlPolylineGeometry vertices: vertices) asElement.

capLine := (BlPolylineGeometry vertices: vertices) asElement.
capLine border: (BlBorder builder
                    paint: Color pink;
                    width: 50;
                    lineCap: BlStrokeLineCap round;
                    build)
```

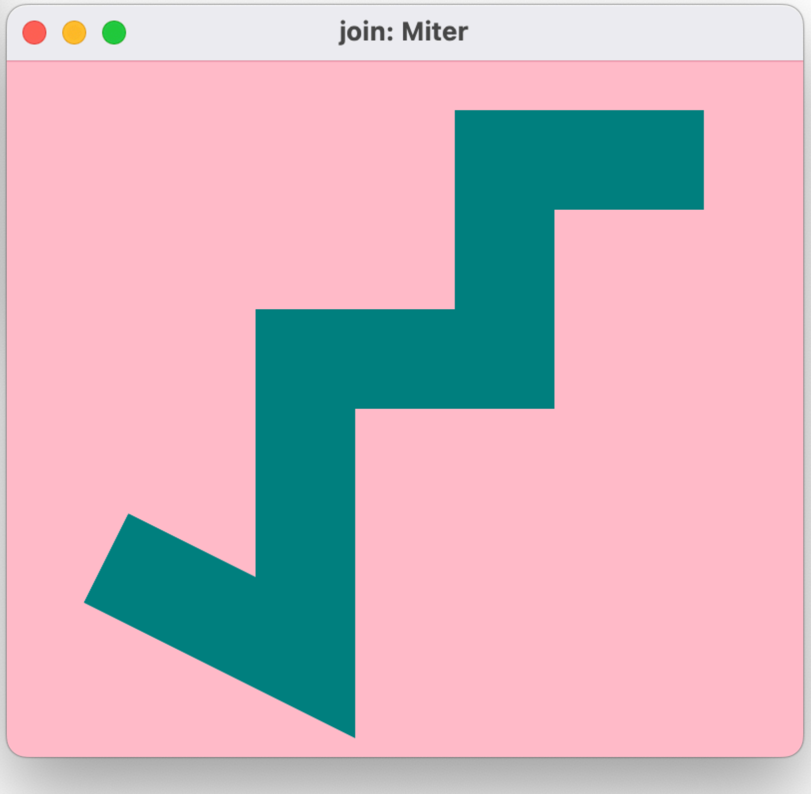
Border's join



join: Round



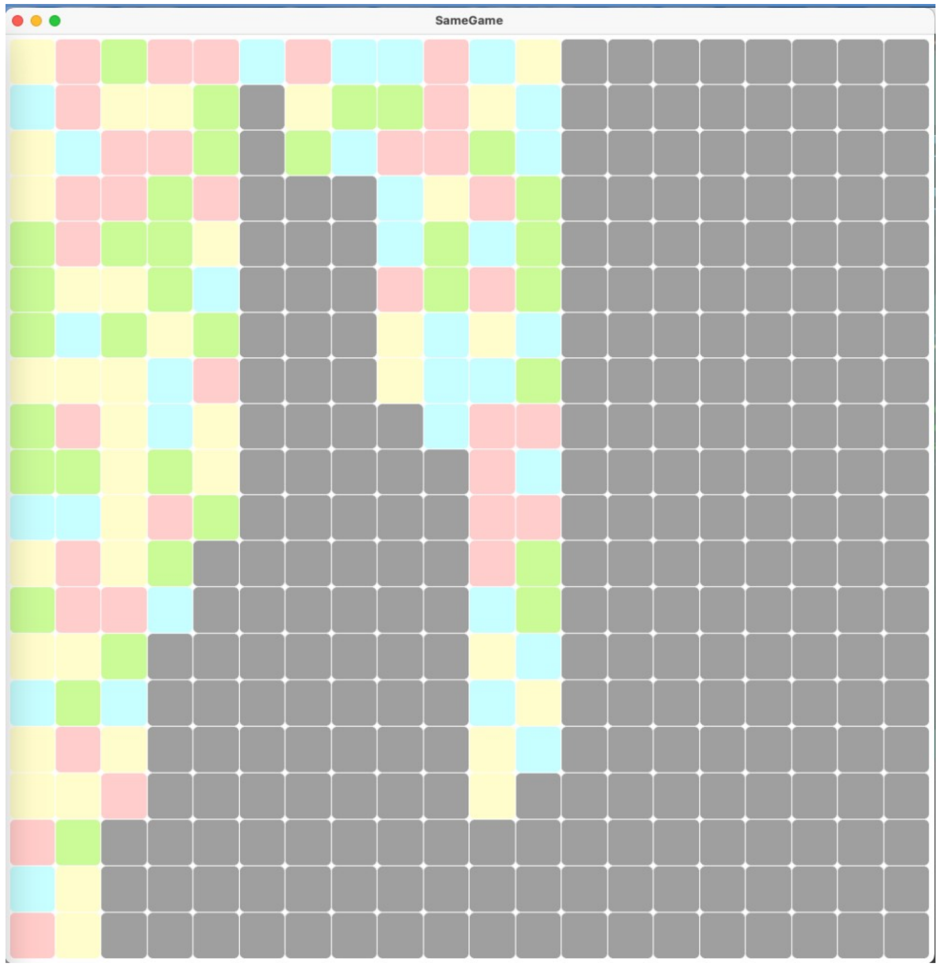
join: Bevel



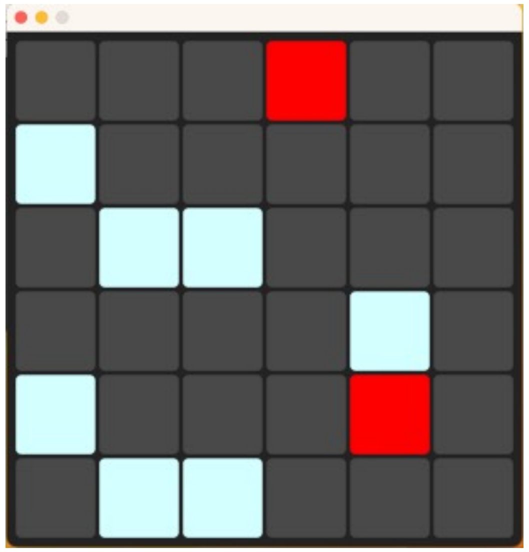
join: Miter

Games

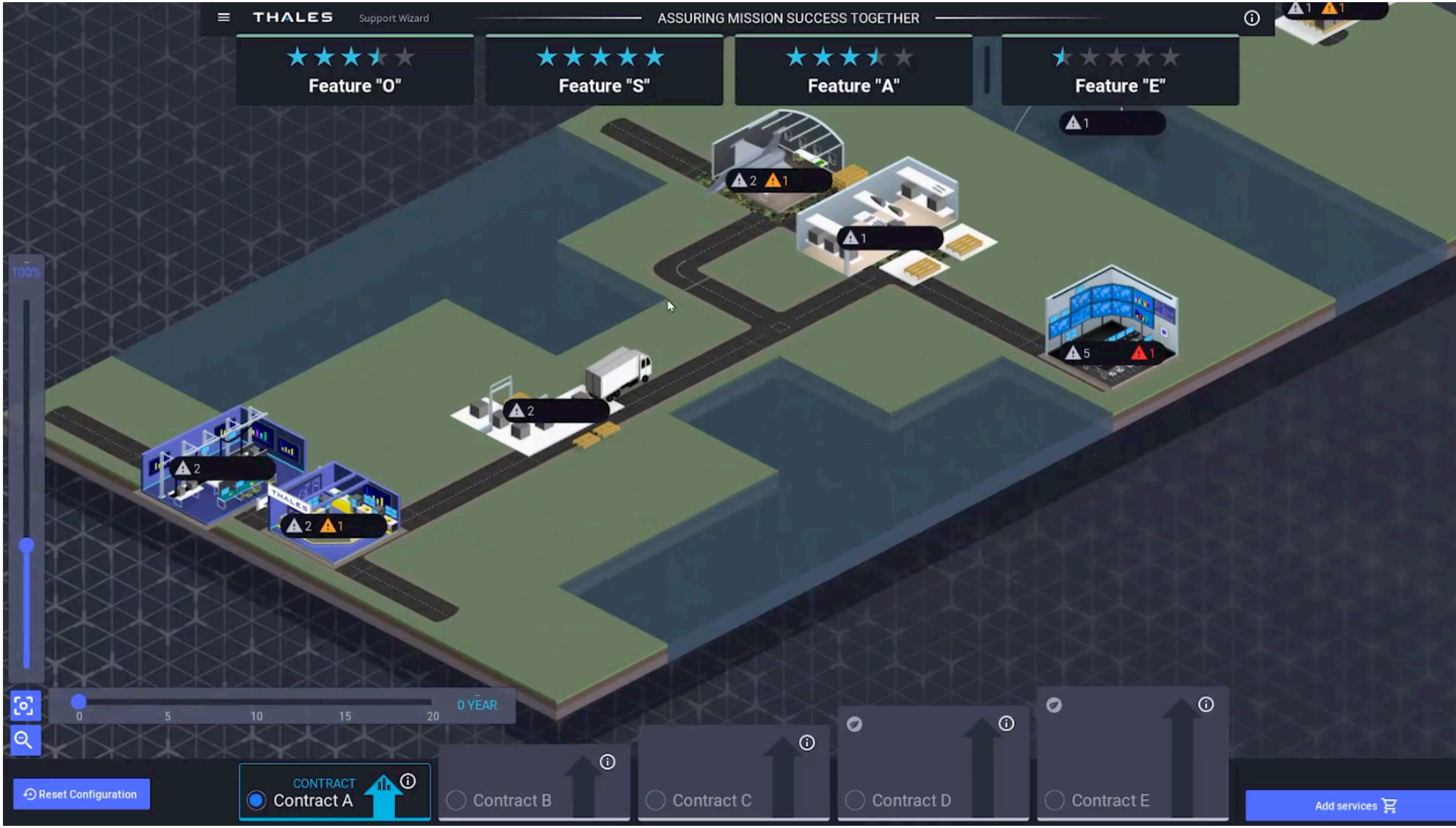
SameGame



Takuzu

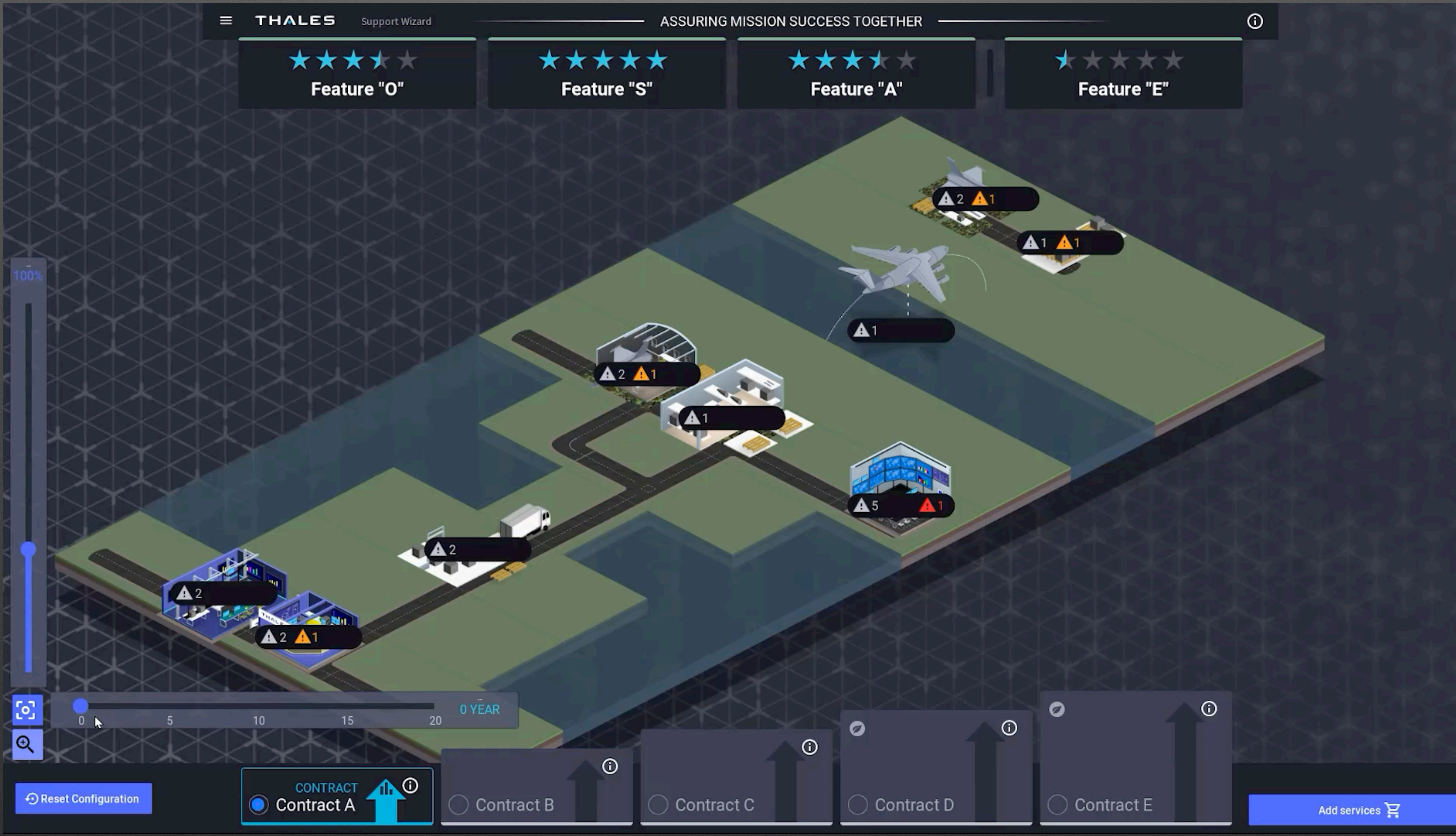


Professional Applications



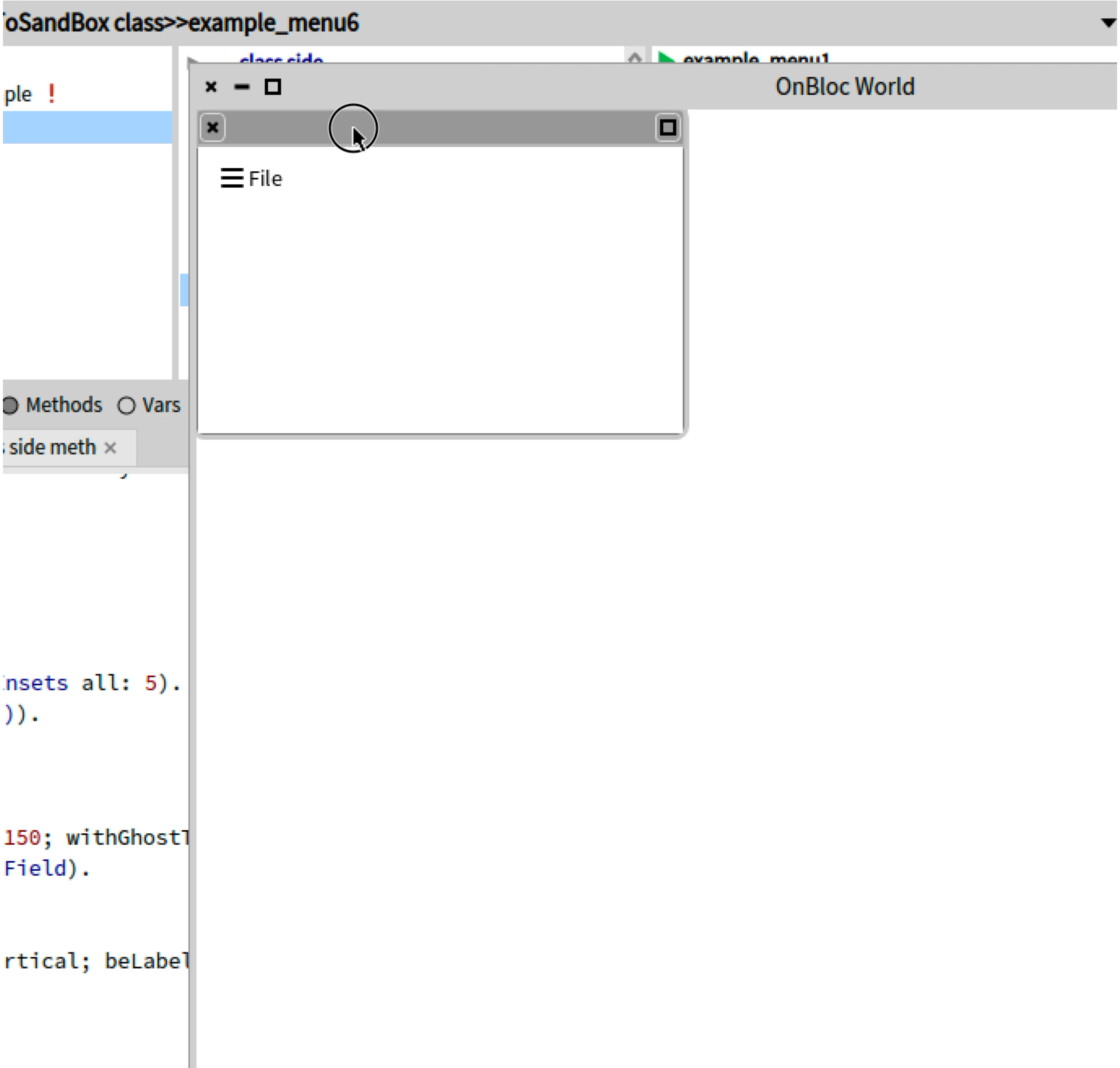
Isometric-based sale simulator

- For salespeople
- Managing contracts and risks
- Developed in 2 months by 3 people with Bloc the new Pharo graphics framework


THALES
Support Wizard
ASSURING MISSION SUCCESS TOGETHER
★★★½☆ Feature "O"
★★★★★ Feature "S"
★★★½☆ Feature "A"
½☆☆☆☆ Feature "E"
100%
2 1
1 1
1
2 1
1
5 1
2
2
2 1
0 5 10 15 20
0 YEAR
Reset Configuration
CONTRACT
● Contract A
○ Contract B
○ Contract C
○ Contract D
○ Contract E
Add services

Toplo

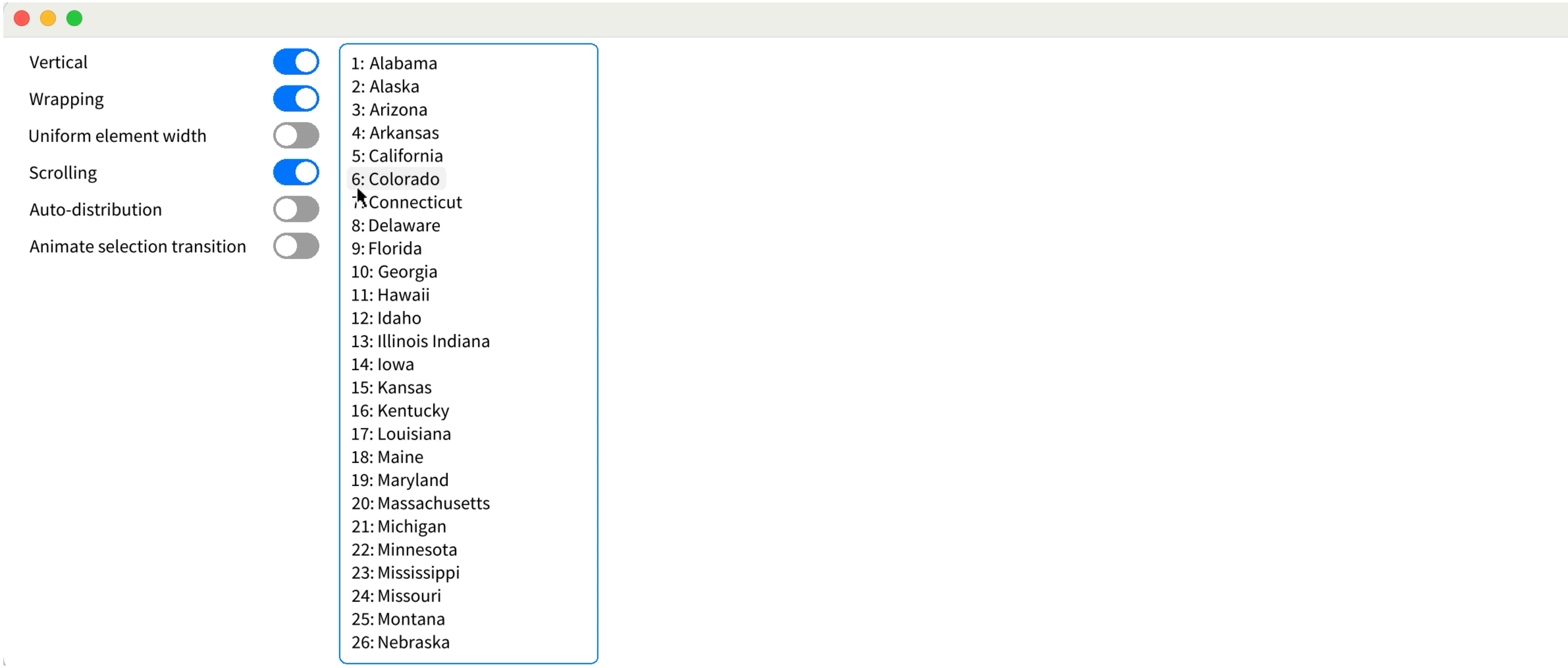
- Basis for Toplo: a new widget library based on http://ant.design design
- Fully skinnable
- Pending trees and table to be ready
- We can define specific widgets and their interaction



```
nsets all: 5).
)).

150; withGhostT
Field).

rtical; beLabel
```



Vertical ☑

Wrapping ☑

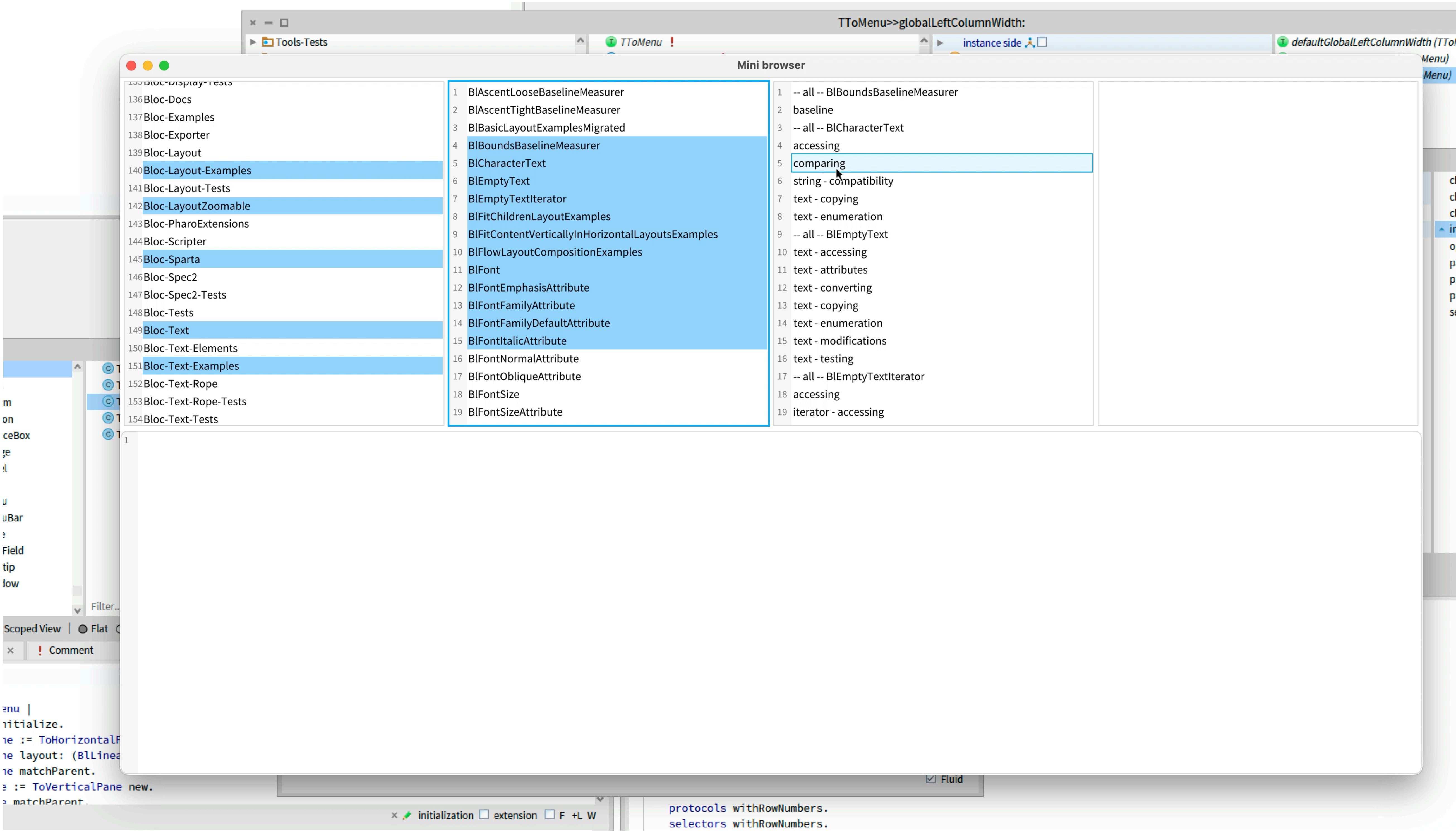
Uniform element width ☐

Scrolling ☑

Auto-distribution ☐

Animate selection transition ☐

1: Alabama
2: Alaska
3: Arizona
4: Arkansas
5: California
6: Colorado
7: Connecticut
8: Delaware
9: Florida
10: Georgia
11: Hawaii
12: Idaho
13: Illinois Indiana
14: Iowa
15: Kansas
16: Kentucky
17: Louisiana
18: Maine
19: Maryland
20: Massachusetts
21: Michigan
22: Minnesota
23: Mississippi
24: Missouri
25: Montana
26: Nebraska



Mini browser

135 Bloc-Display-Tests
136 Bloc-Docs
137 Bloc-Examples
138 Bloc-Exporter
139 Bloc-Layout
140 Bloc-Layout-Examples
141 Bloc-Layout-Tests
142 Bloc-LayoutZoomable
143 Bloc-PharoExtensions
144 Bloc-Scripter
145 Bloc-Sparta
146 Bloc-Spec2
147 Bloc-Spec2-Tests
148 Bloc-Tests
149 Bloc-Text
150 Bloc-Text-Elements
151 Bloc-Text-Examples
152 Bloc-Text-Rope
153 Bloc-Text-Rope-Tests
154 Bloc-Text-Tests

1 BlAscentLooseBaselineMeasurer
2 BlAscentTightBaselineMeasurer
3 BlBasicLayoutExamplesMigrated
4 BlBoundsBaselineMeasurer
5 BlCharacterText
6 BlEmptyText
7 BlEmptyTextIterator
8 BlFitChildrenLayoutExamples
9 BlFitContentVerticallyInHorizontalLayoutsExamples
10 BlFlowLayoutCompositionExamples
11 BlFont
12 BlFontEmphasisAttribute
13 BlFontFamilyAttribute
14 BlFontFamilyDefaultAttribute
15 BlFontItalicAttribute
16 BlFontNormalAttribute
17 BlFontObliqueAttribute
18 BlFontSize
19 BlFontSizeAttribute

1 -- all -- BlBoundsBaselineMeasurer
2 baseline
3 -- all -- BlCharacterText
4 accessing
5 comparing
6 string - compatibility
7 text - copying
8 text - enumeration
9 -- all -- BlEmptyText
10 text - accessing
11 text - attributes
12 text - converting
13 text - copying
14 text - enumeration
15 text - modifications
16 text - testing
17 -- all -- BlEmptyTextIterator
18 accessing
19 iterator - accessing

```
protocols withRowNumbers.
selectors withRowNumbers.
```

Pharo is research friendly

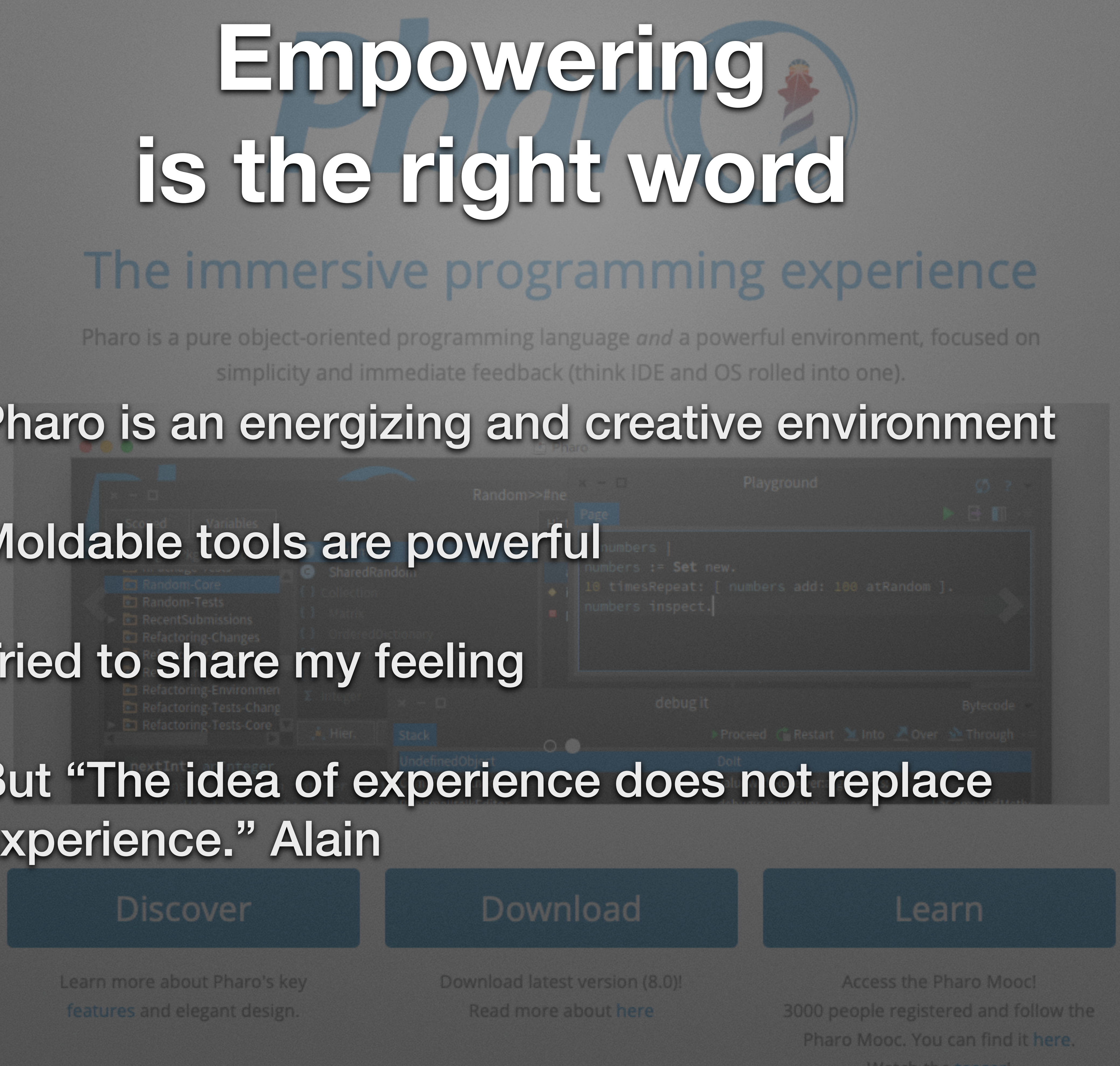
Some International Research Groups

Lafhis (AR)
SCG (CH)
CAR (FR)
RMOD (FR)
Ummisco (IRD)
Reveal (CH)
Lysic (FR)
ENSTA-Bretagne (FR)
CEA-List (FR)
Ryerson (CAN)
OC (FR)
CCMI-FIT (CZ)

ASERG (BR)
Pleiad (CL)
Macau (UNO)
Cirad (FR)
USTH (Vietnam)
Soft-Qual (Serbia)
Uni. Quilmes (AR)
ENIT (FR)
CS (Bo)
Maroua (CAM)
ETS (CAN)

Empowering is the right word

- Pharo is an energizing and creative environment
- Moldable tools are powerful
- Tried to share my feeling
- But “The idea of experience does not replace experience.” Alain



The immersive programming experience

Pharo is a pure object-oriented programming language *and* a powerful environment, focused on simplicity and immediate feedback (think IDE and OS rolled into one).

```
| numbers |
numbers := Set new.
10 timesRepeat: [ numbers add: 100 atRandom ].
numbers inspect.
```

Learn more about Pharo's key features and elegant design.

Download latest version (8.0)! Read more about here

Access the Pharo Mooc! 3000 people registered and follow the Pharo Mooc. You can find it here.

Fun with Us

- 1 hour from Paris, 1:30 from London, 35 min from Brussels
- Internships 3 to 6 months (right now we have 8 interns)
- Google Summer of Code
- PhDs / co supervision (e.g., B. Sarenac)
- Engineer position
- Visitors (Magadascar, Chile, Montreal, …)

Fun, simple

Pure & elegant

Productive

Empowering

Addictive

Full access