what

Towards Structural Decomposition of Reflection with Mirrors

who

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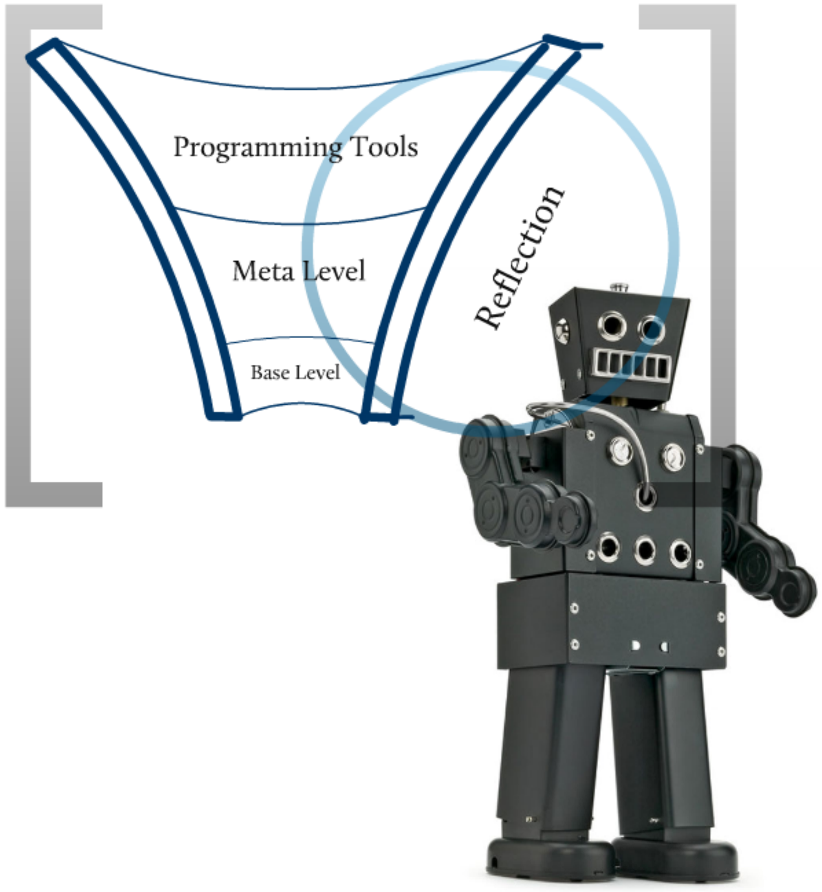
Prezi

why

- Reflection as a pluggable sub-system for:



- Remote Programming
- Resources
- Security
- Cleaner OO Design

Problems with Reflection

- Breaks encapsulation
- Mixed base and meta access
- Resource intentive
- Security / Integrity threat
- No OO design (supporting multiple implementations)

Smalltalk Example

Meta level functionality is indistinguishably mixed in program code.

```
myCar := Car new.
```

sign (supporting multiple
cations)

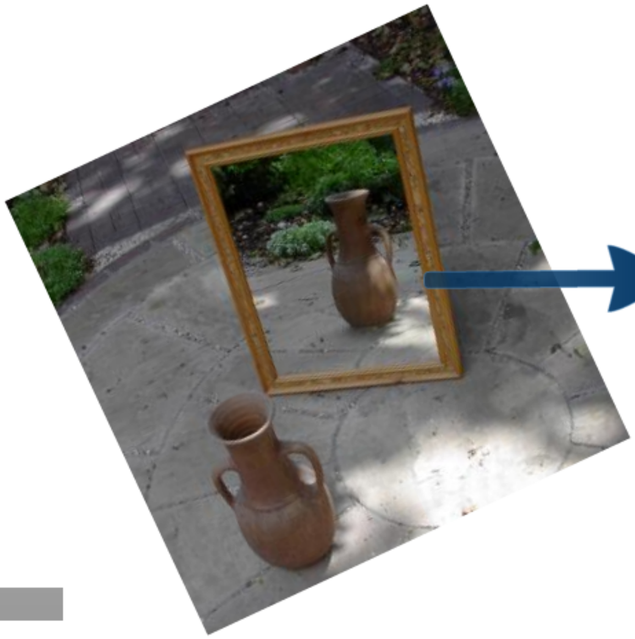
Smalltalk Example

Meta level functionality is indistinguishably mixed in program code.

```
myCar := Car new.
numberOfDoors := myCar numberOfDoors.
carClass := myCar class.
anotherCar := carClass new.
carSuperClass := carClass superclass.
```

Mirrors (Bracha & Unghar 2004)

```
numberOfDoors := myCar numberOfDoors.
carClass := myCar class.
anotherCar := carClass new.
carSuperClass := carClass superclass.
```



Mirrors (Bracha & Unghar 2004)

Functional decomposition of Reflection

- Encapsulation
- Stratification
- Ontological Correspondance

Smalltalk Example - with Mirrors

Meta level functionality is indistinguishably mixed in program code.

```
myCar := Car new.
numberOfDoors := myCar numberOfDoors.
carMirror := Mirror on: myCar.
carClassMirror := carMirror class.
```

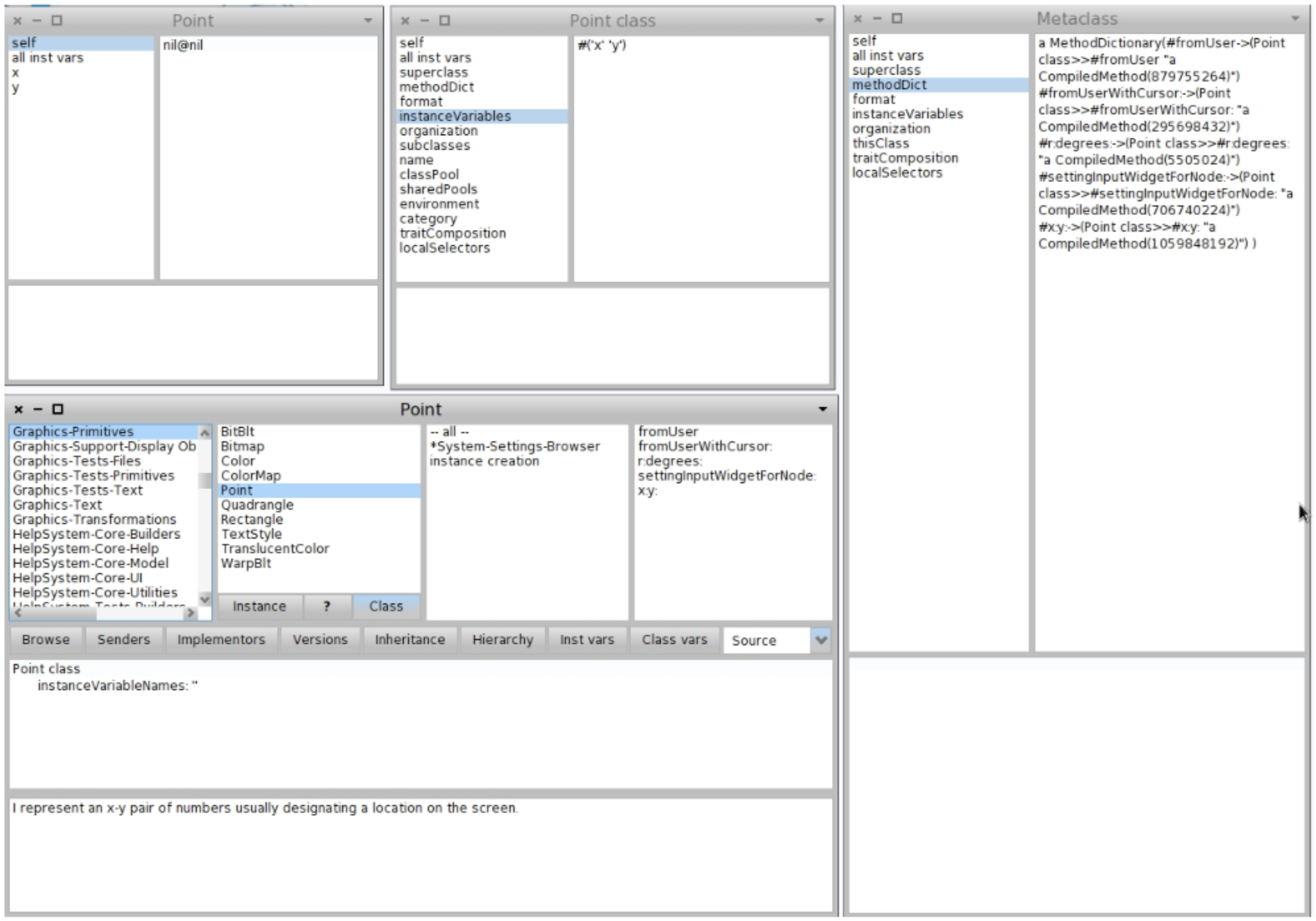
Ontological Correspondance

Smalltalk Example - with Mirrors

Meta level functionality is indistinguishably mixed in program code.

```
myCar := Car new.
numberOfDoors := myCar numberOfDoors.
carMirror := Mirror on: myCar.
carClassMirror := carMirror class.
carClassSuperMirror := carClassMirror superclass.
```

But what about meta-information ?



```
self
all inst vars
x
y
```

```
nil@nil
```

```
self
all inst vars
superclass
methodDict
format
instanceVariables
organization
subclasses
name
classPool
sharedPools
environment
category
traitComposition
localSelectors
```

```
#('x' 'y')
```

```
self
all inst vars
superclass
methodDict
format
instanceVariables
organization
thisClass
traitComposition
localSelectors
```

```
a MethodDictionary(#fromUser->(Point
class>>#fromUser "a
CompiledMethod(879755264)")
#fromUserWithCursor:->(Point
class>>#fromUserWithCursor: "a
CompiledMethod(295698432)")
#r:degrees:->(Point class>>#r:degrees:
"a CompiledMethod(5505024)")
#settingInputWidgetForNode:->(Point
class>>#settingInputWidgetForNode: "a
CompiledMethod(706740224)")
#x:y:->(Point class>>#x:y: "a
CompiledMethod(1059848192)") )
```

```
Graphics-Primitives
Graphics-Support-Display Ob
Graphics-Tests-Files
Graphics-Tests-Primitives
Graphics-Tests-Text
Graphics-Text
Graphics-Transformations
HelpSystem-Core-Builders
HelpSystem-Core-Help
HelpSystem-Core-Model
HelpSystem-Core-UI
HelpSystem-Core-Utilities
```

```
BitBlt
Bitmap
Color
ColorMap
Point
Quadrangle
Rectangle
TextStyle
TranslucentColor
WarpBlt
```

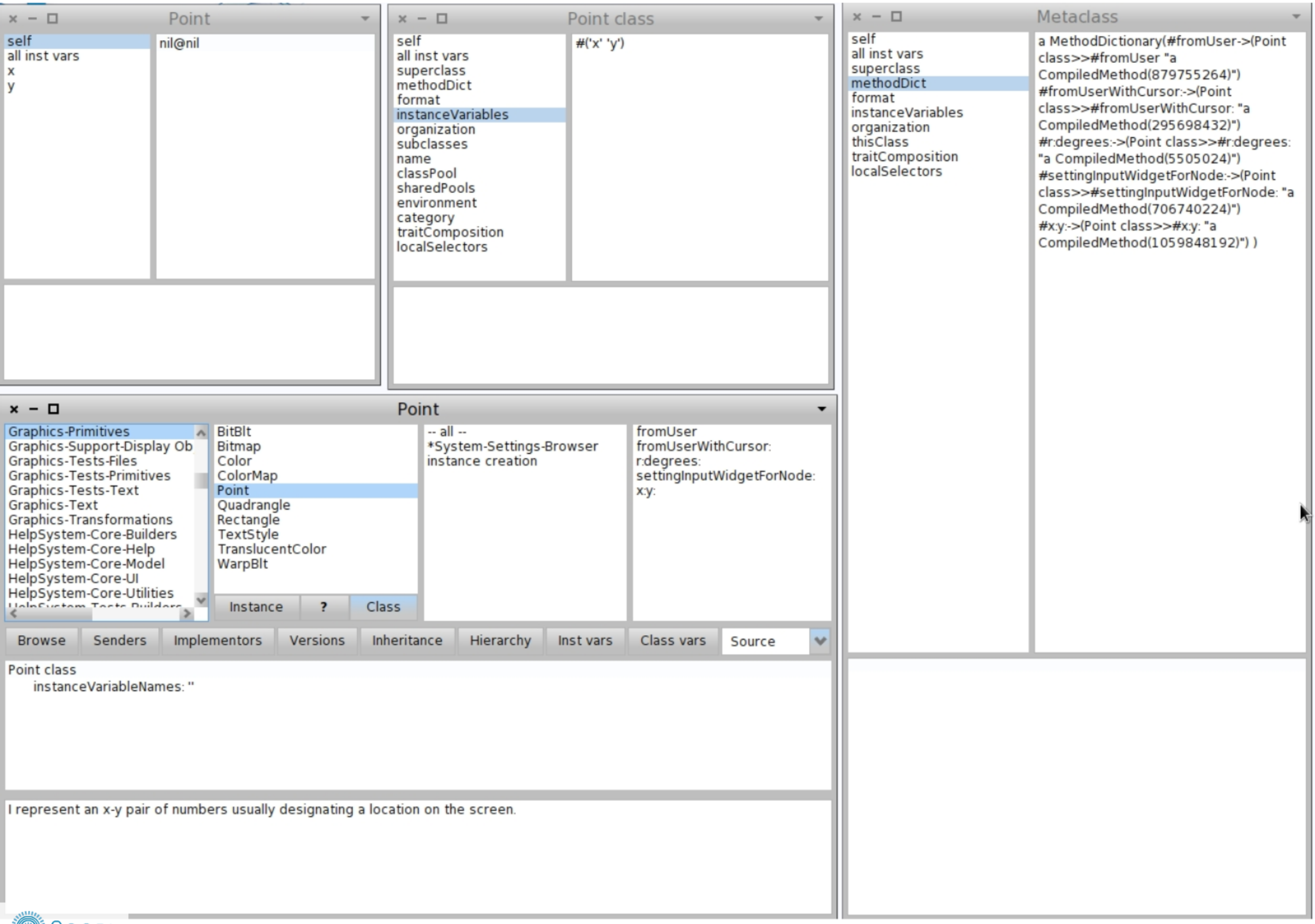
```
-- all --
*System-Settings-Browser
instance creation
```

```
fromUser
fromUserWithCursor:
r:degrees:
settingInputWidgetForNode:
x:y:
```

```
Point class
    instanceVariableNames: ''
```

I represent an x-y pair of numbers usually designating a location on the screen.

Prezi



```
a MethodDictionary(#fromUser->(Point class>>#fromUser "a CompiledMethod(879755264)") #fromUserWithCursor:->(Point class>>#fromUserWithCursor: "a CompiledMethod(295698432)") #r:degrees:->(Point class>>#r:degrees: "a CompiledMethod(5505024)") #settingInputWidgetForNode:->(Point class>>#settingInputWidgetForNode: "a CompiledMethod(706740224)") #x:y:->(Point class>>#x:y: "a CompiledMethod(1059848192)") )
```

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Point class
    instanceVariableNames: ''
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Prezi

impact on:

- Encapsulation/Stratification
- Resources
- Security

Our goal

What is Base and what is Meta ?

There is a powerfull inherent ambiguity !

"With great power comes great responsibility.." --Uncle Ben--

or Voltaire !

Prezi

Our proposition

Our goal

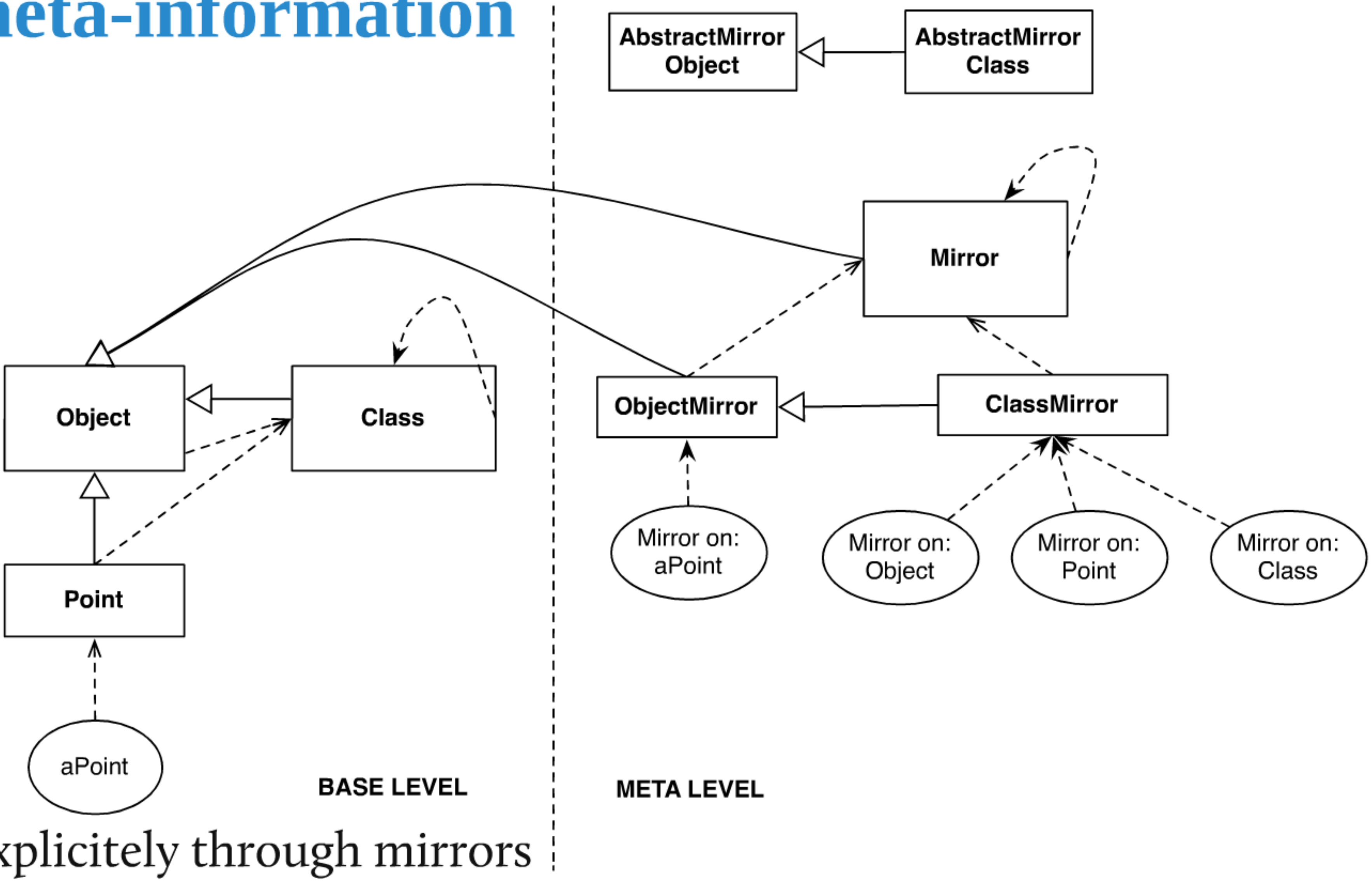
	Smalltalk	Classic mirror-based systems	Our goal
Reflective Functionality	FIX	DISCARDABLE	DISCARDABLE
Meta-Data	FIX	FIX	DISCARDABLE
Base-Level	FIX	FIX	FIX

all the power, without the responsibility

• V
whe

Our proposition

Mirrors as the storage entities of meta-information



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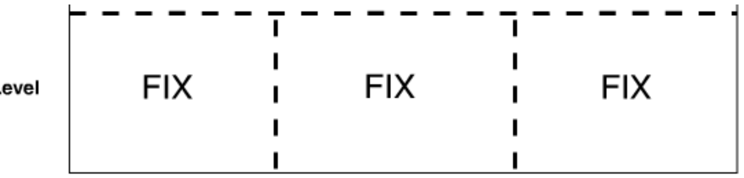
ection explicitely through mirrors
ur can only be done through mirrors



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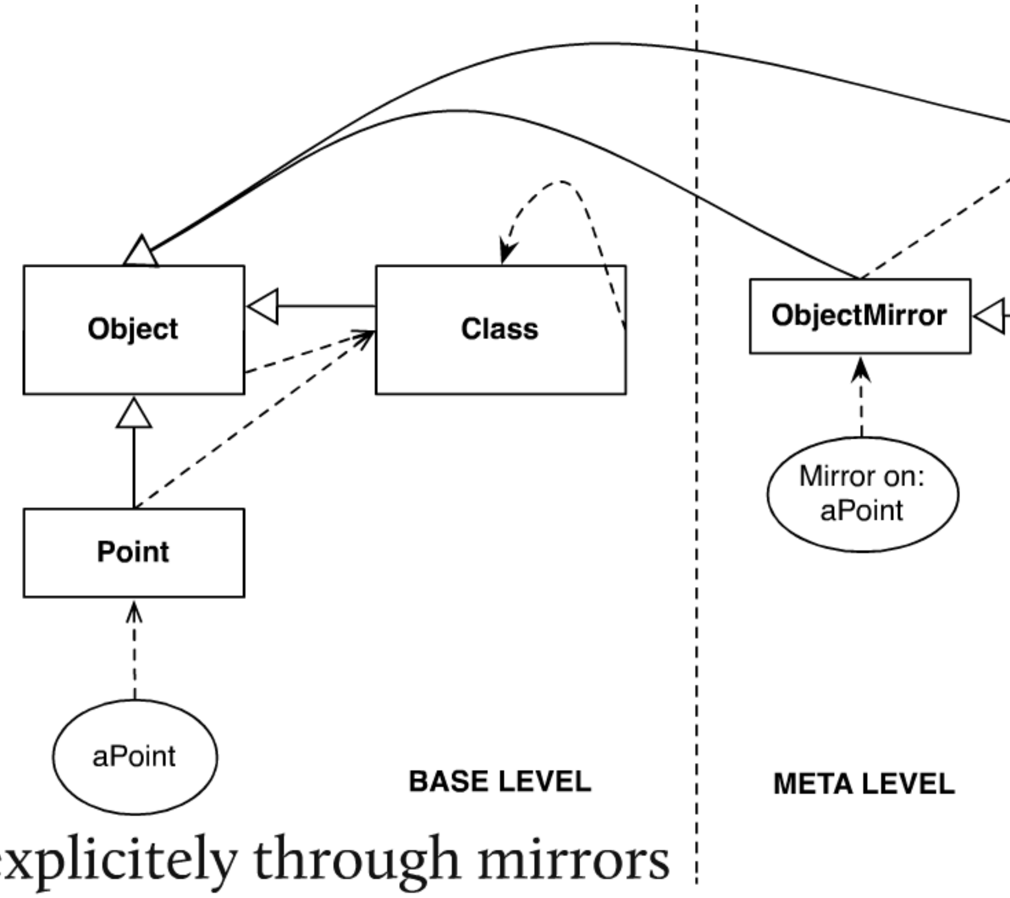
the responsibility



- every object has a mirror
- mirrors hold all meta-information
- all other entities provide reflection explicitely through mirrors
- dynamic addition of behaviour can only be done through mirrors

Validation & Prototype

MetaTalk

Whole system: VM, Compiler, Object Model implemented on top of Pharo.

Sound execution of base level functionality both:

- In the presence and
- In the absence of mirrors
- Validated complete stratification of meta-information

when they are not needed.

Related Work

- Bracha and Unghar 2004
- Lorenz and Vlissides 2003
- Declarative model for Smalltalk

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Related Work

- Bracha and Unghar 2004
- Lorenz and Vlissides 2003
- Declarative model for Smalltalk
- Resilient
- Mirages and AmbientTalk

Future Work

... small

Ontological Correspondance....

- Metrics
- Behavioral Reflection
- Remote Programming (case studies)

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- Metrics
- Behavioral Reflection
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http://squeaksource/MetaTalk

Thank you !