Cuis Smalltalk Method Finder
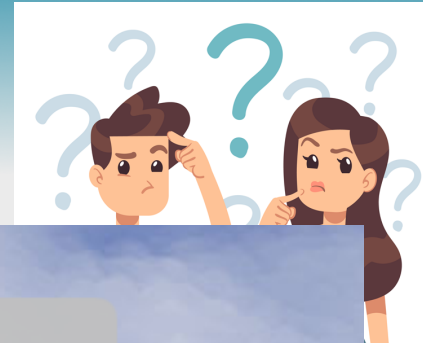
R. Mark Volkmann
Object Computing, Inc.
✉ r.mark.volkmann@gmail.com
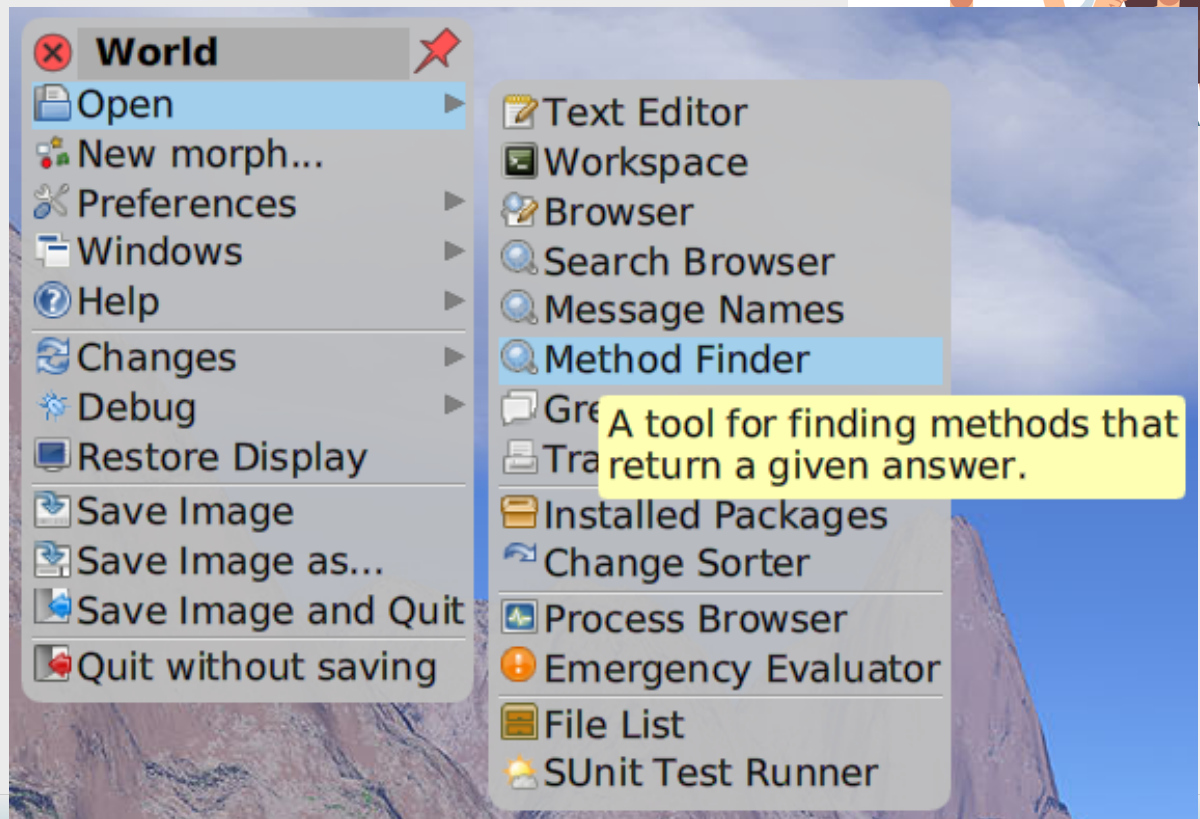
Slides at **https://github.com/mvolkmann/talks/**
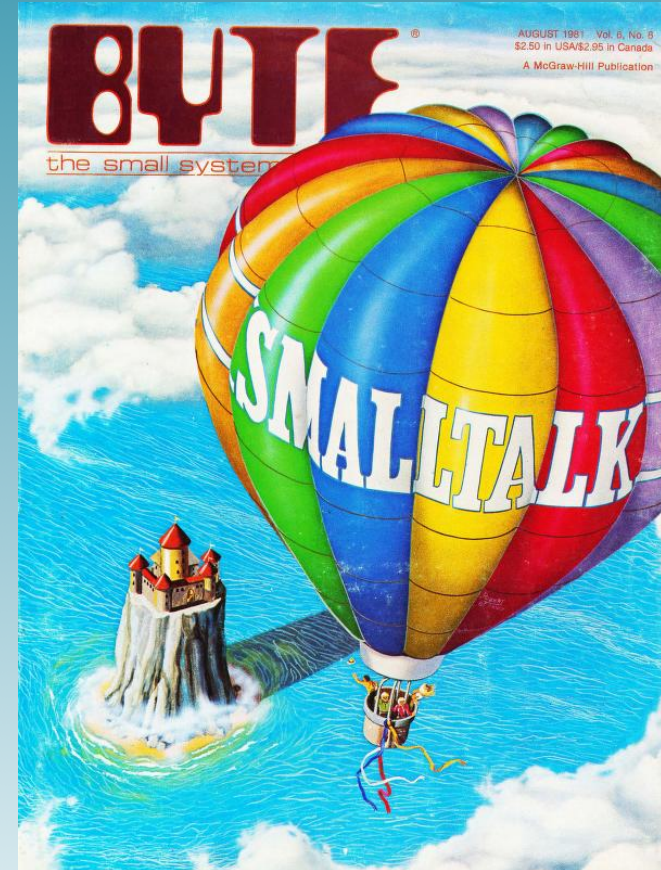
OBJECT COMPUTING
YOUR OUTCOMES ENGINEERED

What is it?

- Tool for finding methods
  - on given receiver
  - that take given arguments
  - and produce given result
- Open World menu
- Hover over "Open"
- Click "Method Finder"

The GUI

Method Finder

Receiver: 2

Arguments (dot—separated): 2

Expected: 4

Find Methods 7 matching methods were found.

Integer digitAdd:
Number ^
Number raisedTo:
Number raisedToInteger:
Number raisedToNegativeInteger:
SmallInteger ∗
SmallInteger +

jmv 8/1/2019 19:23:05 ° 20 message sends ° mathematical functions ° 3 implementors ° 24 direct senders ° in no package ° in no change set

| browse | senders | implementors | versions | inheritance | hierarchy | inst vars | class vars |

raisedTo: *exponent*
    "Answer the receiver raised to aNumber."

    exponent isInteger ifTrue: [
        "Do the special case of integer power"
        ↑ self raisedToInteger: *exponent*].
    exponent isFraction ifTrue: [
        "Special case for fraction power by Nicolas Cellier:
        If aNumber is a fraction, but result must be a Float, learn it as quickly as possible, and give quick Float
answer
        Allows evaluating:
        (2009/2000) raisedTo: (3958333/100000)
        "
        ↑ self raisedToFraction: *exponent*].
    self < 0 ifTrue: [
        ↑**NegativePowerError** new signalReceiver: self selector: **#raisedTo:** argument: *exponent*].
    0.0 = *exponent* ifTrue: [↑ self class one].   *"Special case of exponent=0"*

Utilizes classes from **SearchBrowser**
by Mariano Montone in
https://github.com/Cuis-Smalltalk/Cuis-Smalltalk-Tools

`MethodFinderWindow` is a subclass of
`SearchBrowserWindow` which is a subclass of
`MethodSetWindow` which is a subclass of
`CodeWindow` which is a subclass of
`SystemWindow`

From Workspace

- Open Workspace

- Evaluate expression like
  `MethodFinder methodFor: #(2 2 4)`

- Prints to Transcript

```
7 matching methods were found.
- SmallInteger *
- SmallInteger +
- Number ^
- Integer digitAdd:
- Number raisedTo:
- Number raisedToInteger:
- Number raisedToNegativeInteger:
```
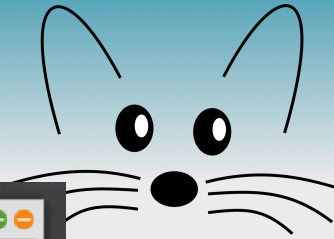
Installing

- Clone repository
  - `git clone https://github.com/mvolkmann/Cuis-Smalltalk-MethodFinder`
- Open a Cuis image
- Open a Workspace
- Evaluate `Feature require #MethodFinder`

In Squeak

How Does It Work? ...

- Takes string expressions for receiver, arguments, and expected

- Compiles string expressions to objects

  - `Compiler evaluate:` *`expressionString`*

  - can detect when an expression is invalid, but can't describe why

- Gets all selectors for receiver found in its class and all superclasses

  - `receiverObject class allSelectors`

... How Does It Work? ...

- Rejects selectors that

  - do not take specified number of arguments

  - are in `SkipSet` (a `Set` initialized in `MethodFinder` class method `initialize`)

  - are understood by the `Behavior`, `ChangeSet`, or `ClassDescription` classes

  - include the substring `'halt'` in any case

  - begin with `'fileOut'` or `'handleFailing'`

> **PROBLEM:** We can't anticipate dangerous methods that might be added in the future.

... How Does It Work?
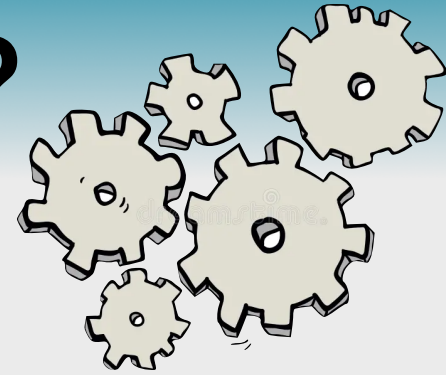
- Iterates over remaining selectors to find **matches**
  - makes **veryDeepCopy** of receiver
  - makes **veryDeepCopy** of arguments array

```
actualObject :=
    [receiverCopy perform: selector withArguments: argumentsCopy]
        on: Error
        do: [ :ex | nil ].

actualObject isKindOf: Float :: and: [ expectedObject isKindOf: Float] ::
    ifTrue: [ actualObject - expectedObject :: abs <= 0.001 ]
    ifFalse: [ actualObject = expectedObject ].
```

- Returns **matches asSortedCollection**

Potentially Dangerous

Assumptions are made and most assumptions are wrong.

- Albert Einstein

- Blindly executing methods is dangerous
  - could modify existing classes and methods in bad ways
  - could prompt for input
  - could produce unwanted output
  - could be very slow
  - could crash image
- Examples
  - **removeFromSystem**
  - **shutDown**

"Forget the receiver from the Smalltalk global dictionary.
Any existing instances will refer to an obsolete version of the receiver."

`self terminateScreenUpdater`

How Does Squeak Differ?

- **MethodFinder** instance method **initialize**
  creates a **Set** of "approved" selectors
  - also see instance method **noteDangerous**
  - class variables **Approved**, **AddAndRemove**, and **Dangerous**
    are used in instance method **organizationFiltered**
- The Good
  - no possibility of sending dangerous messages
- The Bad
  - can only send messages for registered selectors, so new ones won't be found

Wrap Up

It's an interesting and
potentially dangerous tool.
How can it be improved?

Question:

Recently I noticed that Cuis locks up when an image is started in macOS by double clicking and the window is dragged to another monitor. Can someone verify if this happens for them?

Slides at https://github.com/mvolkmann/talks/
Package at https://github.com/mvolkmann/Cuis-Smalltalk-MethodFinder