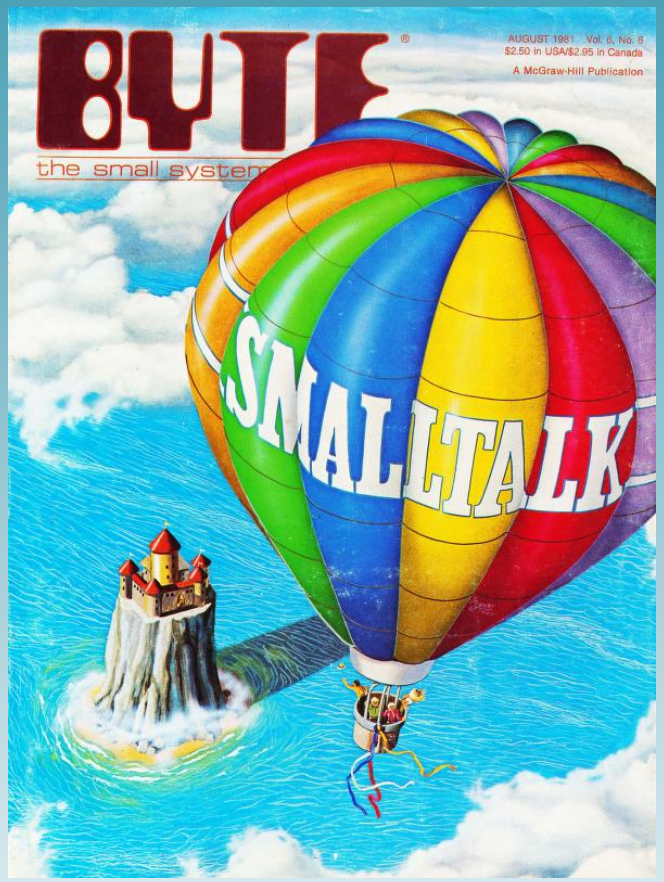
Cuis Smalltalk Method Finder



R. Mark Volkmann
Object Computing, Inc.
https://objectcomputing.com
mark@objectcomputing.com
@mark_volkmann

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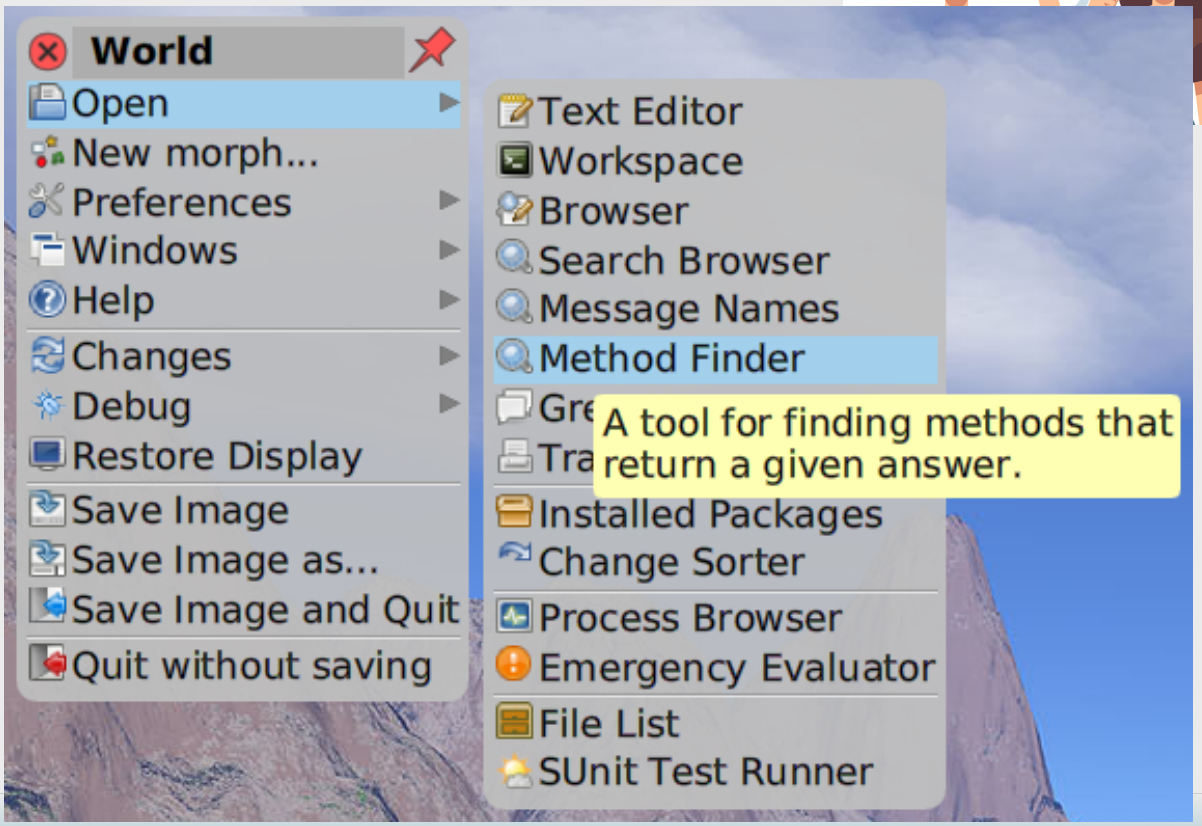
Slides at **https://github.com/mvolkmann/talks/**

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

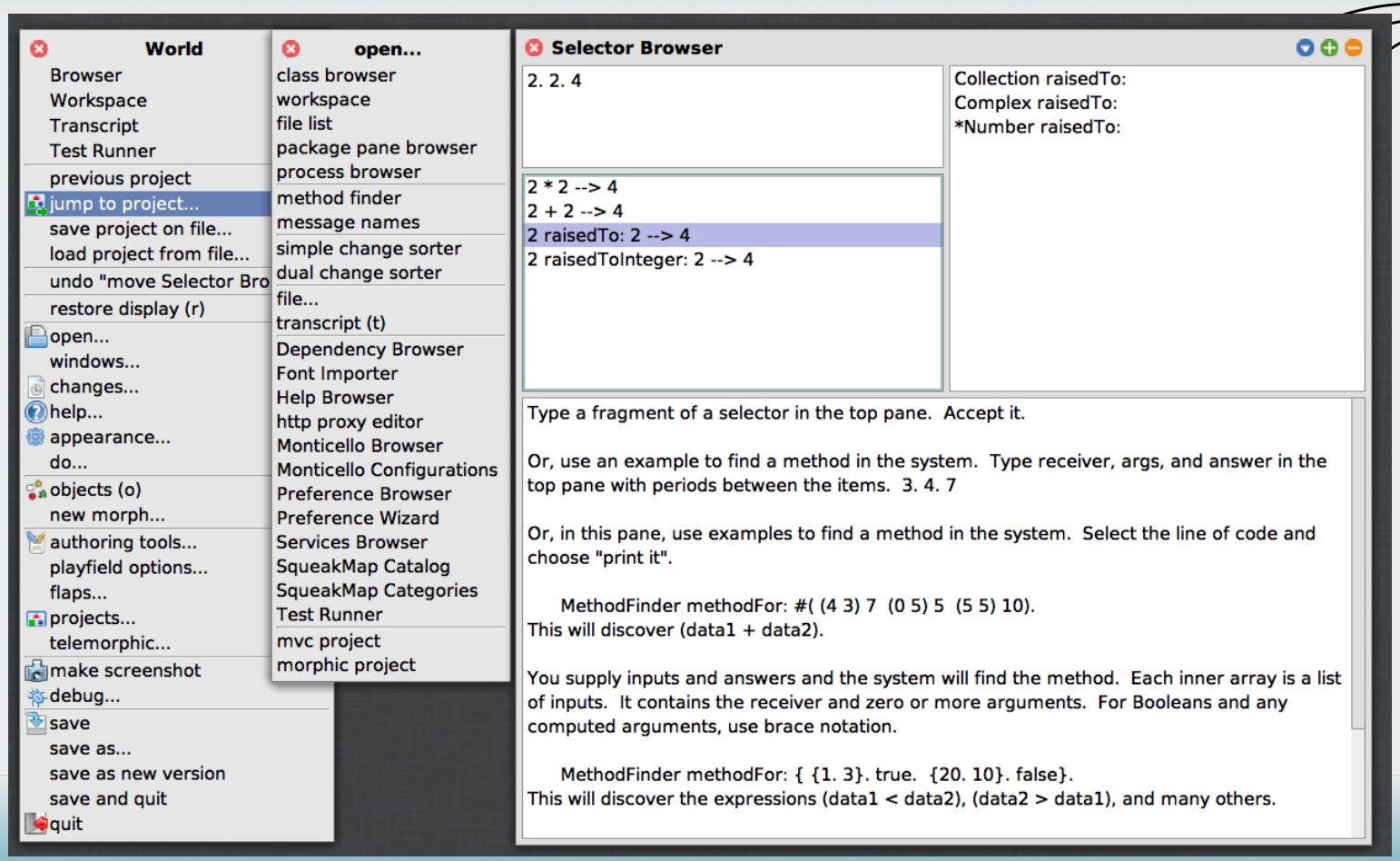
- Open Workspace
- Evaluate expression like
  `MethodFinder methodFor: #(2 2 4)`
- Prints to Transcript

```
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


World
Browser
Workspace
Transcript
Test Runner
previous project
jump to project...
save project on file...
load project from file...
undo "move Selector Bro
restore display (r)
open...
windows...
changes...
help...
appearance...
do...
objects (o)
new morph...
authoring tools...
playfield options...
flaps...
projects...
telemorphic...
make screenshot
debug...
save
save as...
save as new version
save and quit
quit
open...
class browser
workspace
file list
package pane browser
process browser
method finder
message names
simple change sorter
dual change sorter
file...
transcript (t)
Dependency Browser
Font Importer
Help Browser
http proxy editor
Monticello Browser
Monticello Configurations
Preference Browser
Preference Wizard
Services Browser
SqueakMap Catalog
SqueakMap Categories
Test Runner
mvc project
morphic project
Selector Browser
2. 2. 4
Collection raisedTo:
Complex raisedTo:
*Number raisedTo:
2 * 2 --> 4
2 + 2 --> 4
2 raisedTo: 2 --> 4
2 raisedToInteger: 2 --> 4
Type a fragment of a selector in the top pane. Accept it.
Or, use an example to find a method in the system. Type receiver, args, and answer in the top pane with periods between the items. 3. 4. 7
Or, in this pane, use examples to find a method in the system. Select the line of code and choose "print it".
MethodFinder methodFor: #((4 3) 7 (0 5) 5 (5 5) 10).
This will discover (data1 + data2).
You supply inputs and answers and the system will find the method. Each inner array is a list of inputs. It contains the receiver and zero or more arguments. For Booleans and any computed arguments, use brace notation.
MethodFinder methodFor: { {1. 3}. true. {20. 10}. false}.
This will discover the expressions (data1 < data2), (data2 > data1), and many others.

How Does It Work? ...

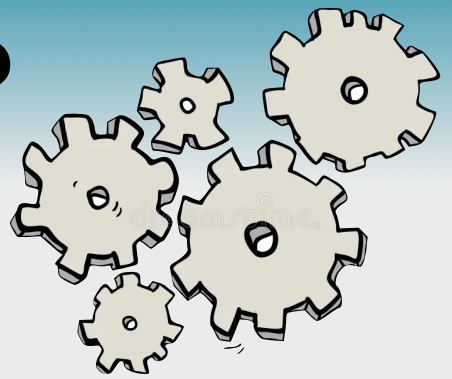
- Takes string expressions for receiver, arguments, and expected
- Compiles string expressions to objects
  - **`Compiler evaluate: `*`expressionString`**
  - can detect when an expression is invalid, but can't describe why
- Gets all selectors for receiver found in its class and all superclasses
  - **`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 ].
```

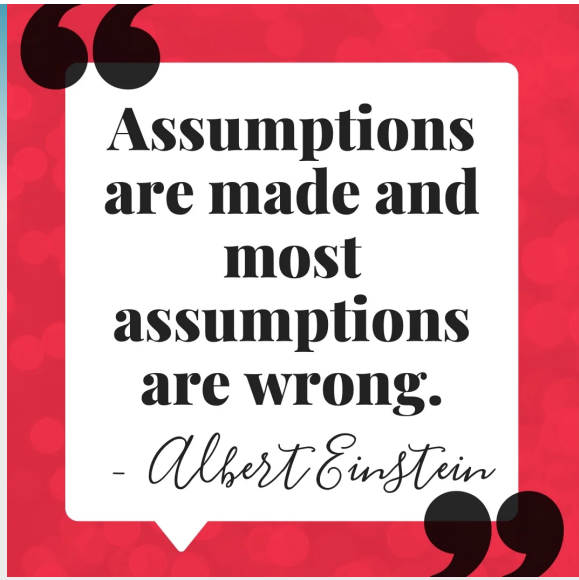
- Returns **`matches asSortedCollection`**

Potentially Dangerous

- 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`**

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

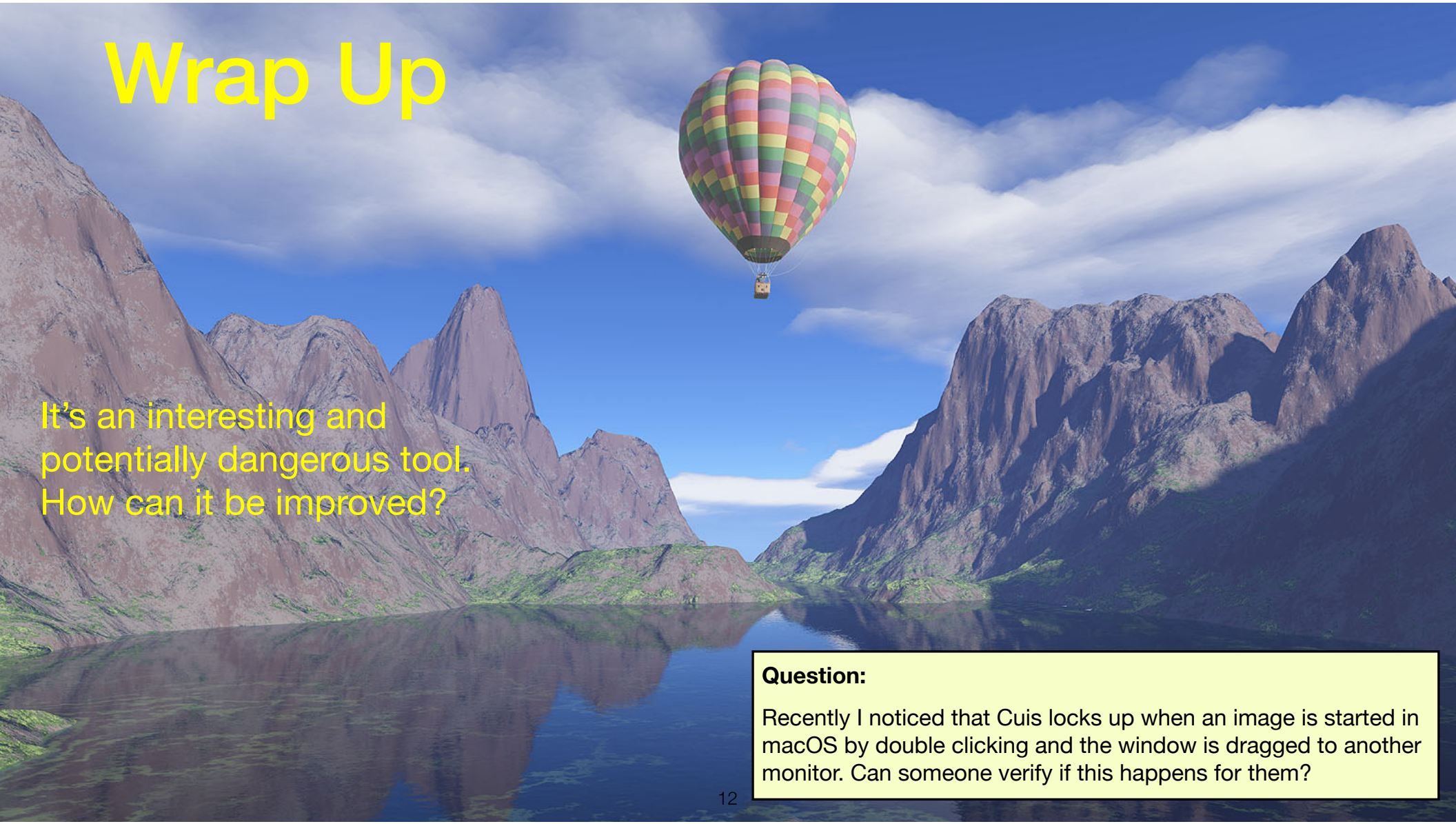
    ```
    self terminateScreenUpdater
    ```



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?