

GUI application with Cuis-Smalltalk

Hilaire Fernandes

Department of Public Instruction
Geneva

November 2023



About me

- Educator in public school, Geneva, B.Math, Ma.Ed
- Computer scientist, Ma.CS, PhD.CS
- Free software enthusiast and user since 1998
- And of course, Smalltalk user since 2002

Contents

- 1 Why this workshop?
- 2 Organise your disk
- 3 Packages
- 4 IDE
- 5 App Design
- 6 Localise
- 7 Build the application

Why writing a GUI application with **Smalltalk**?

- Portable application
- Rapid prototyping
- To explore concepts and new ideas
- To learn from the environment itself
- Culture of design patterns
- Culture of testing
- Moldable environment
- Bugs hunt is fun, and fixes too

Why writing a GUI application with **Cuis-Smalltalk**?

- A libre Smalltalk, it ensures **the four fundamental freedoms**:
 - 1 to run it,
 - 2 to study and to modify it,
 - 3 to distribute copy of it,
 - 4 to distribute modified version of it.
- A Smalltalk system for humble human being
 - ⇒ system complexity under control, not on your way
- Cuis's **Morph mark III** makes Morph correct
 - ⇒ hierarchy, coordinates system, floating point precision
- State of the art **Vector Graphics** engine
 - ⇒ make your app beautifully
- Develop your own vector widget
 - ⇒ with SVG icons

A guide for the beginners

These workshop and related documents:

- A step by step guide to get started elaborating a Cuis App
- How to organize your code
- Expose the different parts needed for a Cuis App,
- Which packages to rely on
- Which design patterns you may want to use
- *How to write your own vector widget* ⇒ sorry not this time
- Which resources to use

An image viewer

Application with toolbar to view image and to operate transformations with undo/redo commands (World Menu-New Morph, AppView).



How to follow the workshop?

Don't take note or use your computer, only write down this url for later use.

`https://github.com/hilaire/CuisApp`

Enjoy the ride!

From scratch

The free operating system GNU/Linux is used along some Bash commands and scripts. You also need the `git` tool to access the Cuis repositories. Mac OS X should be fine.

On Windows, you need to adapt the Bash script to Microsoft shell.

⇒ In your disk, create a new folder “myProject” for your project:

```
mkdir myProject
```

This is the place where you will pull the needed Cuis repositories, the virtual machine and the repository dedicated to your Cuis App.

Cuis image

We need to clone the Cuis official repo to get the latest image and updates along additional repositories of libraries we want to use. We suggest you read latter the official guides to keep this repository updated[5].

```
cd myProject
git clone --depth 1 \
    https://github.com/Cuis-Smalltalk/Cuis-Smalltalk-Dev.git
cd Cuis-Smalltalk-Dev
./clonePackageRepos.sh
```

Virtual Machine

Get the latest virtual machine for GNU/Linux[5]:

```
cd myProject
rm -r cogspur
wget -O cogspur.tgz \
    https://github.com/OpenSmalltalk/opensmalltalk-vm/\
    releases/latest/download/squeak.cog.spur_linux64x64.tar.gz
tar -zxvf cogspur.tgz
mv ./sqcogspur64linuxht ./cogspur
```

⇒ Test you can start Cuis:

```
../cogspur/squeak Cuis6.0-6xxx
```

Additional repositories

We want to install the SVG & Cuis-Smalltalk-UI repositories:

```
cd myProject
git clone --depth 1 https://github.com/Cuis-Smalltalk/\
  Cuis-Smalltalk-UI.git
git clone --depth 1 https://github.com/Cuis-Smalltalk/\
  SVG.git
git clone --depth 1 https://github.com/Cuis-Smalltalk/\
  Numerics.git
```

It installs the repositories Cuis-Smalltalk-UI and SVG as folders in myProject/. They contains package files .pck.st.

CuisApp

Cuis is repository agnostic. Use whatever suits you to manage your Cuis app code¹.

⇒ For your **myApp**, you just clone its repository in the Cuis-Smalltalk-Dev folder:

```
cd myProject/Cuis-Smalltalk-Dev  
git clone http://github.com/hilaire/CuisApp
```

⇒ All the source codes and related resources needed for our Cuis application will go there.

¹For Dr. Geo I use Bazaar/Launchpad because it offers a web tool to edit translations in native languages[2]

Folders

We need places for the source code, scripts, resources, i18n(Internationalization), build:

```
cd myProject/Cuis-Smalltalk-Dev/CuisApp
mkdir src i18n build
mkdir -p resources/graphics/icons resources/doc
```

In a Cuis workspace, you request a package as a Feature:

```
Feature require: 'UI-Components'
```

This installs the UI-Components package and more. It comes from the Cuis-Smalltalk-UI/lib repository.

In fact it is a meta-package, read it:

```
!provides: 'UI-Components' 1 4!  
!requires: 'Cuis-Base' 60 5032 nil!  
!requires: 'UI-DragAndDrop' 1 0 nil!  
!requires: 'UI-Entry' 1 3 nil!  
!requires: 'UI-Click-Select' 1 1 nil!  
!requires: 'UI-Panel' 1 5 nil!  
!requires: 'UI-Widgets' 1 0 nil!
```

Open it from the menu in the world World-Open-Installed Packages:

Package Name	File Name
Collections-CompactArrays 1.14	/myProject/Cuis-Smalltalk-Dev/Packages/System/C
Compression 1.33	/myProject/Cuis-Smalltalk-Dev/Packages/Features/
Graphics-Files-Additional 1.27	/myProject/Cuis-Smalltalk-Dev/Packages/Features/
UI-Click-Select 1.47	/myProject/Cuis-Smalltalk-UI/lib/UI-Click-Select.p
UI-Components 1.4	/myProject/Cuis-Smalltalk-UI/lib/UI-Components.p
UI-Core 1.5	/myProject/Cuis-Smalltalk-UI/lib/UI-Core.pck.st
UI-DragAndDrop 1.17	/myProject/Cuis-Smalltalk-UI/lib/UI-DragAndDrop.p
UI-Entry 1.43	/myProject/Cuis-Smalltalk-UI/lib/UI-Entry.pck.st
UI-Panel 1.94	/myProject/Cuis-Smalltalk-UI/lib/UI-Panel.pck.st
UI-Widgets 1.23	/myProject/Cuis-Smalltalk-UI/lib/UI-Widgets.pck.st

save new delete/merge changes browse addRequrmnt

Package: UI-Click-Select -- From Cuis 6.0 [latest update: #5979] on 10 October 2023 at 11:18:31 pm -- Number of system categories 1. -- Number of classes: 12. Number of extension methods: 0. Total number of methods: 156. Total lines of code:

I supply simple click-select elements.

FeatureRequirement(Cuis-Base 60.5031 to *.*)
FeatureRequirement(UI-Core 1.0 to *.*)

delete update

Our CuisApp package

To manage the code of our CuisApp, we create a package “CuisApp” and add the dependent packages we need:

```
| package |  
package := CodePackage  
    named: 'CuisApp'  
    createIfAbsent: true  
    registerIfNew: true.  
package featureSpec  
    requires: (FeatureRequirement name: 'SVG');  
    requires: (FeatureRequirement name: 'UI-Components');  
    requires: (FeatureRequirement name: 'Goodies');  
    requires: (FeatureRequirement name: 'Gettext').  
package save
```

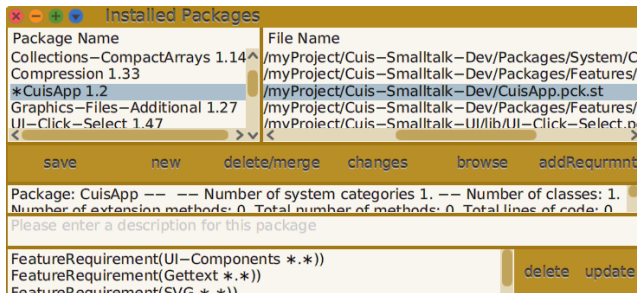
⇒ The package is saved along the Cuis image, in Cuis-Smalltalk-Dev.

Package content

In the class browser, we create a CuisApp class in the category **CuisApp**.

⇒ All classes in the categories CuisApp and CuisApp-### are automatically part of the CuisApp package. All the methods in the system categorized as *CuisApp are also part of the CuisApp package.

Observe in the package manager the dependencies and the * indicating there are changes in the CuisApp package:



Test our package:

- From the package manager, save once more the CuisApp package, then move its file CuisApp.pck.st in CuisApp/src, in the CuisApp repository.
- Quit Cuis without saving
- Restart Cuis and in a workspace execute:

```
Feature require: 'CuisApp'
```

Our CuisApp package and its dependencies are installed at once. However our working environment is still a mess. We will address that.

Objectives

There are good habits to have when starting a new Cuis development session. To keep it up-front, we better automatise the involved processes:

- Use a fresh Cuis image at each start up
- Keep the default fresh Cuis image untouched
- Clean up from previous development session
- Install packages
- Adjust the Cuis environment to our taste

Run script

Clean-up from previous session, start Cuis with a copied fresh image and Smalltalk set up script:

```
#!/bin/bash
# Start CuisApp IDE
#
# Cuis Version release
release='ls Cuis6.0-?????.image | cut -d - -f 2 | \
    cut -d . -f 1'
cuis=Cuis6.0-$release
ide=CuisAppIDE
# Clean up from previous session
rm $ide.image $ide.changes $ide.user.* *.log
# Create fresh image for next session
cp $cuis.image $ide.image
cp $cuis.changes $ide.changes
../cogspur/squeak $ide -s CuisApp/src/setupIDE.st
```

Image configuration

When our `startIDE.sh` Bash script is executed, it starts Cuis with the `setupIDE.st` Smalltalk instructions to install our development environment:

- Start your IDE:

```
cd Cuis-Smalltalk-Dev  
./CuisApp/startIDE.sh
```
- install latest Cuis update
- adjust a few preferences: log, author, font size
- install our CuisApp package
- delete all windows
- open and layout 5 windows: 3 Class Browsers, a Transcript and a Workspace with default content

Installed

The screenshot displays the Cuis-Smalltalk IDE interface, which is divided into several panes. The top-left pane is the **System Browser**, showing a tree view of the system's classes and objects. The top-right pane is also a **System Browser**, but it is focused on the **String** class, showing its methods and a list of subclasses. The bottom-left pane is the **Workspace**, which contains a list of recent snapshots and a running instance of the application. The bottom-right pane is the **Transcript**, which shows the output of the application, including the results of the **String** class definition and a list of subclasses.

System Browser (Left):

- Kernel
 - Collections
 - Exceptions
 - Compiler
 - System
 - Graphics
 - Morphic
 - Tools
 - LinearAlgebra

System Browser (Right):

- Kernel
 - Collections
 - Exceptions
 - Compiler
 - System
 - Graphics
 - Morphic
 - Tools
 - LinearAlgebra
- CharacterSequence
 - String
 - Symbol
 - UnicodeString
 - UnicodeSymbol
 - CharacterSet

Workspace:

ChangeSet installNewUpdates.

-----SNAPSHOT----- (24 October 2023 21:05:59) CuisAppIDE.image priorSource: 6285966
Cuis 6.0
latest update: #6054
Running at: /home/hilaire/Travaux/Developpement/bmp/myProject/Cuis-Smalltalk-Dev/CuisAppIDE.image

-----SNAPSHOT----- (24 October 2023 21:08:42) CuisAppIDE.image priorSource: 7341034

Transcript:

-----SNAPSHOT----- (24 October 2023 21:05:59) CuisAppIDE.image priorSource: 6285966
Cuis 6.0
latest update: #6054
Running at: /home/hilaire/Travaux/Developpement/bmp/myProject/Cuis-Smalltalk-Dev/CuisAppIDE.image

-----SNAPSHOT----- (24 October 2023 21:08:42) CuisAppIDE.image priorSource: 7341034

System Browser: String

- Kernel
 - Objects
 - Classes
 - Numbers
 - Text
 - Chronology
 - Methods
 - Processes
 - Collections
- CharacterSequence
 - String
 - Symbol
 - UnicodeString
 - UnicodeSymbol
 - CharacterSet

Class definition for String * 58 Instance methods * 47 class methods * 721 total message sends

CharacterSequence variableByteSubclass: #String

instanceVariableNames: ""
classVariableNames: ""
poolDictionaries: ""
category: 'Kernel-Text'

A String is an indexed collection of Characters. In Cuis, Characters are represented in the Latin-9 (ISO 8859-15) encoding. Each character takes 1 byte.

String support a vast array of useful methods, which can best be learned by browsing and trying out examples as you find them in the code.

Here are a few useful methods to look at...

String match:

Which ones?

There are best practices, our CuisApp:

- **MVP.** Model-View-Presenter for GUI application.
- **Strategy.** Present a set of methods with different implementations depending on the platform.
- **Command.** To undo/redo operation for construction, delete, property, merge, move commands

⇒ If you are serious about developing an application, you should read a book about design patterns[4].

In Dr. Geo

A few more in Dr. Geo:

- **Factories.** It manufactures new models, keeps record of the manufactured models and check for duplicated models.
- **Tools.** Tool and state objects to process multiple-steps user input in the canvas. Tools is instantiated by the presenter, once the user selected a given construction menu.
- **Builder.** Model builders. Fed by the user input via the selected tool to gradually construct an mathematics item.

General considerations

In MVP[3] there are three objects:

- **Model (Domain object).** It represents the domain. It does not know about the view and presenter.
- **View.** It shows the model and the controls (buttons, etc.) to manipulate it. It knows about the presenter.
- **Presenter.** It handles the operations on the model. It knows about the model and the view.

⇒ The controls in the views are handled by the presenter. Models are unaware of the views and presenter.

⇒ The Presenter is the entry point in the application.

In CuisApp

Our **Domain** object is around a fileEntry:

```
Object subclass: #AppDomain
  instanceVariableNames: 'fileEntry'
  classVariableNames: ''
  poolDictionaries: ''
  category: 'CuisApp-Model'
```

Our **View** is around an ImageMorph instance:

```
SystemWindow subclass: #AppView
  instanceVariableNames: 'image presenter'
  classVariableNames: ''
  poolDictionaries: ''
  category: 'CuisApp-View'
```

And the **Presenter**, knows about the domain and view through the controlsManager:

```
Object subclass: #App
  instanceVariableNames: 'domain controlManager cmdManager'
  classVariableNames: ''
  poolDictionaries: ''
  category: 'CuisApp-Presenter'
```

Presenter is central

Instantiating the Presenter start the application:

```
App>>initialize
  domain := AppDomain new.
  controlManager := AppControlManager for: self.
  controlManager installAppView.
  cmdManager := AppCommandManager new presenter: self.
  self view openInWorld
```

We use an auxiliary object AppControlManager to arrange the view: we keep low the complexity in our AppView and to implement alternate arrangement by subclassing AppControlManager.

Controls

The controls are installed in the view by the `AppControlManager`:

```
AppControlManager>>installAppView
| scroller |
  view := AppView for: presenter.
  scroller := PluggableScrollPane new ::
    layoutSpec: LayoutSpec useAll;
    scroller: view imageMorph.
  view addMorph: self appToolbar layoutSpec: (LayoutSpec
    fixedHeight: AppSystem iconToolbarSize + 4).
  view addMorph: scroller
```

The toolbar

```
AppControlManager>>appToolbar
| toolbar |
    toolbar := LayoutMorph newRow
        separation: 5;
        yourself.
    self appTools do: [:aTool |
        aTool == #spacer
            ifTrue: [toolbar addMorphUseAll: self class spacer]
            ifFalse: [toolbar addMorph: (self button: aTool )]].
↑ toolbar
```

Each tool is described in its own method:

```
AppControlManager>>openButtonData
" label - iconName - callback - description "
↑ {'Open' translated . #open . #openImage .
   'Select a picture to visualize and to operate with.' translated
```

Observe the #translated message sent to the tool label and description.

The tool

Observe, the model of the button is the Presenter, action is sent to it:

```
AppControlManager>>button: symbol
"array first = menu label or button label
array second = button form = section mode
array third = symbol callback
array fourth = help string"
| array |
  array := self perform: (symbol, #ButtonData) asSymbol.
  ↑ ButtonMorph
model: presenter
  action: array third ::
  enableSelector: (
    symbol == #open ifTrue: [true] ifFalse: [#isButtonActive]);
  icon: (icons get: array second size: AppSystem iconToolbarSize);
  setBalloonText: array fourth;
  ../..
```

Callback

Let's take a look to the #openImage callback:

```
App>openImage
| answer |
  answer := (StandardFileMenu new
    oldFileFrom: AppSystem picturesPath
    withPattern: '*.png *.jpg *.jpeg'
    excludePattern: '.*')
    startUpWithCaption: 'Pick up a picture' translated.
  answer ifNotNil: [
    domain fileEntry: answer directory // answer name.
    cmdManager release]
```

⇒ The domain is updated with the fileEntry of the newly selected picture.
Do you think there is a missing piece?

Observer pattern

How the View knows about a newly selected image? We use the Observer pattern. The Domain triggers a `#newImageSelected` event:

```
AppDomain>>fileEntry: aFileEntry  
fileEntry := aFileEntry.  
self triggerEvent: #newImageSelected
```

⇒ Our View is listening to the `#newImageSelected` event:

```
AppView>>initialize  
../..  
self domain when: #newImageSelected  
send: #loadImage to: self
```

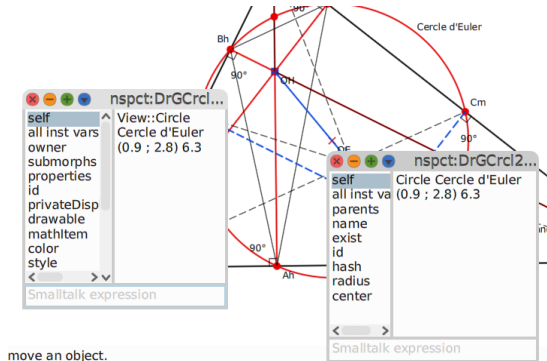
⇒ And the method `loadImage` is called:

```
AppView>>loadImage  
image image: (ImageReadWriter  
formFromFileEntry: self domain fileEntry).  
self update: #relabel
```

Caution with Observer pattern

A costly mechanism to use with parsimony, for high level UI controls.

In Dr. Geo canvas, math model (circle below) and its view (morph) are not coupled with the observer pattern. Canvas is updated with a top-down redraw of the views, it is faster.



General considerations

Three objects:

- A command manager, `AppCommandManager`, to execute specific command
- A command stack, `AppCommandStack`, where are stacked the command instances
- A hierarchy of command, `AppCommand`, each specialized in one type of operation

Two important command methods: `execute` and `unexecute`

Let's observe it with the rotate right operation.

Rotate right callback

When the button is pressed in the toolbar, the Presenter's method is executed:

```
App>>rotateRight  
cmdManager rotateRight
```

The command manager create the command, add it to the stack then execute it:

```
AppCommandManager>>rotateRight  
|command|  
  command := stack nextPut:  
    (AppRotateCommand presenter: presenter).  
  command degrees: 90.  
  ↑ command execute
```

Rotate right command

Observe the execute method. As the execute command is not destructive, the unexecute method just rotate the image in the other direction:

```
AppRotateCommand>>execute  
  self imageMorph image: (self rotatedBy: degrees)
```

```
AppRotateCommand>>unexecute  
  self imageMorph image: (self rotatedBy: degrees negated)
```

⇒ For destructive command as zoom out – we definitely lose image pixels – we have to keep a copy of the original image:

```
AppZoomOutCommand>>execute  
  cacheForm := self imageMorph form.  
  self imageMorph image: (cacheForm magnifyBy: 0.5)
```

```
AppZoomOutCommand>>unexecute  
  self imageMorph image: cacheForm
```

Modus operandi 1/2

Your application in native language. It need the “Gettext” and “System-Locales” Cuis packages.

- In the code, you write strings in English.
- You send the message #translated to each string you want to be translated:
`... startUpWithCaption: 'Pick up a picture' translated.`
- You define your translation domain based on Class category:

`TextDomainManager`

```
registerCategoryPrefix: 'CuisApp'  
domain: 'cuisapp'.
```

⇒ Our domain is called “cuisapp”. In the classes of the category “CuisApp”, it tracks the strings with the #translated message sent.

Modus operandi 2/2

- You export the messages to translate to a .pot template file:

```
GetTextExporter exportTemplate
```

⇒ It creates a file

```
Cuis-Smalltalk-Dev/po/cuisapp/cuisapp.pot
```

- You copy this file to CuisApp/i18n/locale/
- To translate to Spanish, you copy this file as “es.po” and translate it to your native language
- Add Spanish code “es” in the scripts buildLocales.sh and update-po.sh
 - ⇒ Execute buildLocales.sh each time you edited a .po file
 - ⇒ Execute update-po.sh when the original exported file cuisapp.pot was renewed because of additional messages to translate or messages edited in the code.

makeBundle

The bash script `makeBundle.sh`:

- Must be executed from `Cuis-Smalltalk-Dev` directory
- Prepare the image:

```
./CuisApp/build/makeBundle.sh --build
```
- Make a bundle for GNU/Linux and Windows:

```
./CuisApp/build/makeBundle.sh --package gnulinux
```

```
./CuisApp/build/makeBundle.sh --package windows
```


Questions?



CuisApp template



Dr. Geo repository at launchpad with translation management



<https://www.martinfowler.com/eaDev/uiArchs.html>



Sherman R. Alpert, Kyle Brown, Bobby Woolf, The Design Patterns Smalltalk Companion, Addison-Wesley, 1998



Setting up and starting Cuis Smalltalk