UCI University of California, Irvine

Informatics 134

Software User Interfaces
Spring 2021

Mark S. Baldwin
baldwinm@ics.uci.edu

5/11/2021

Agenda

1. Upcoming
2. Layout and Geometry Management
3. User Interface Layout Tools

Upcoming

Upcoming

- T3 Critiques on Thursday. Attend and participate for participation points.
- Lecture next Tuesday on accessibility
- Keep working on T3 (DUE EOQ, Critique 5/13)
- Keep working on A3 (DUE 5/18)

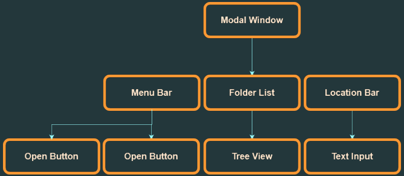
Layout and Geometry Management

Layout and Geometry Management

From Primitives to Containers

Quick Recap

- Graphical toolkits are hierarchical
- Build widgets with graphical primitives
- Build widgets with widgets

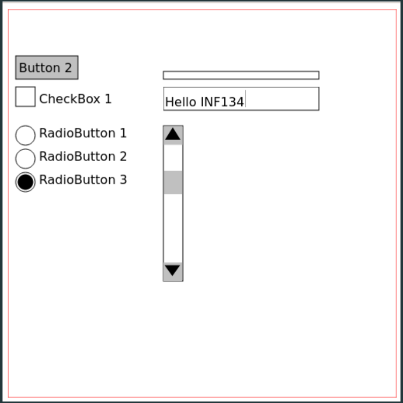


Layout and Geometry Management

From Primitives to Containers

Building widgets with widgets...

> Think about what we are building for A3...How might we build new widgets with our widgets?

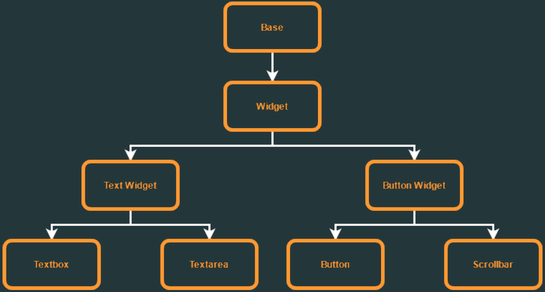


Layout and Geometry Management

From Primitives to Containers

Some examples...

- Scrollbar -> Scroll Pane
- Button -> Scrollbar button
- Textbox -> Text Area, other text input widgets
- Checkbox and Radiobutton -> Selection or boolean widget

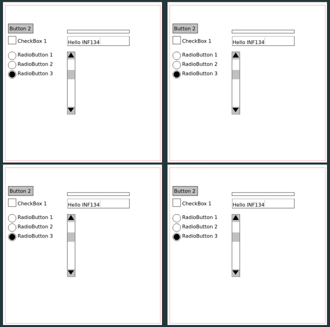


Layout and Geometry Management

From Primitives to Containers

Containers...store and manage individual widgets

- Individual widgets are placed in containers (like our 'window' ex.)
- Containers can be placed in containers
- Design patterns...



Layout and Geometry Management

From Primitives to Containers

Decorator pattern: add behavior to an existing [graphical] object

[Wikipedia, 2021b]

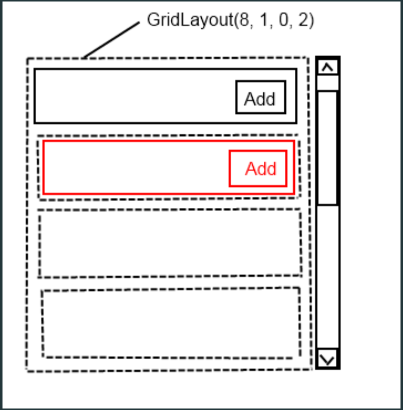
- Extend functionality of object
- Does not change expected behavior of object
- Examples ???

Layout and Geometry Management

From Primitives to Containers

Decorator pattern: add behavior to an existing [graphical] object [Wikipedia, 2021b]

- Extend functionality of object
- Does not change expected behavior of object
- Example: Scrollable list (a list widget decorated with a scroll pane)



[java2s.com, 2021]

Layout and Geometry Management

From Primitives to Containers

Composite pattern: a [graphical] object that can behave as a single object or a collection of objects [Wikipedia, 2021a]

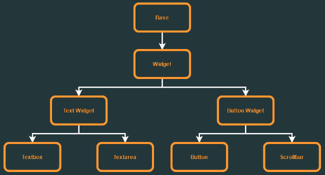
- Conceptually similar to recursive logic, lists of lists...
- Containers of containers can lead to more complex interfaces, but easier to maintain and reason about

Layout and Geometry Management

From Primitives to Containers

This approach is common across nearly all graphical toolkits

- Take advantage of OOP concept of inheritance
- Can build parallel hierarchies for themes, resources, etc.
- Support layout!!!



How are you arranging your widgets for your demo page?

Layout and Geometry Management

From Containers to Layout Managers

As a GUI grows in complexity, there will be a need for layout and geometry management!

Must support:

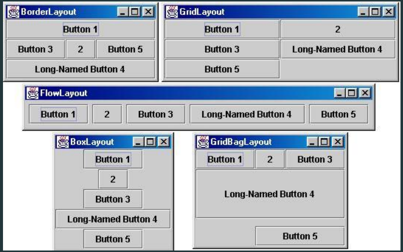
- Different devices
- Screen sizes
- Resolutions
- Accessibility (more on this next week!)

Layout and Geometry Management

From Containers to Layout Managers

A good example from Java Swing

- Layout types apply different algorithms to arrange widgets automatically



Layout and Geometry Management

From Containers to Layout Managers

Managing layout

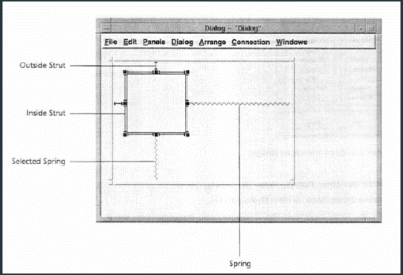
- Layout is controlled by a manager rather than the widget
- Rules can be applied to individual widgets (min width, left align, etc.)
- Conceptually similar to HTML and CSS, rules vary

Layout and Geometry Management

From Containers to Layout Managers

Implementations vary across time and toolkit

- Historically ”Struts and Springs” most prevalent
- Most toolkits offer variations on grid, fixed, placed
- Most are constraint-based (program rules, let engine adjust based on external criteria)



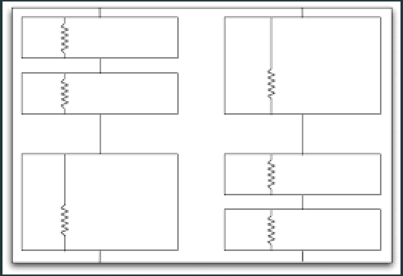
[Hudson and Mohamed, 1990]

Layout and Geometry Management

From Containers to Layout Managers

Struts and Springs: a constraint based layout

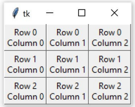
- Struts are rigid points of attachment to a nearby object
- Springs are flexible points of attachment to a nearby object
- What happens when the window pictured here is resized?



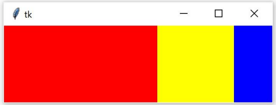
Layout and Geometry Management

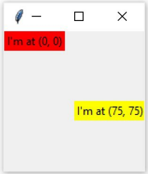
From Containers to Layout Managers

TKinter's Grid/Pack/Place



Row 0 Column 0	Row 0 Column 1	Row 0 Column 2
Row 1 Column 0	Row 1 Column 1	Row 1 Column 2
Row 2 Column 0	Row 2 Column 1	Row 2 Column 2



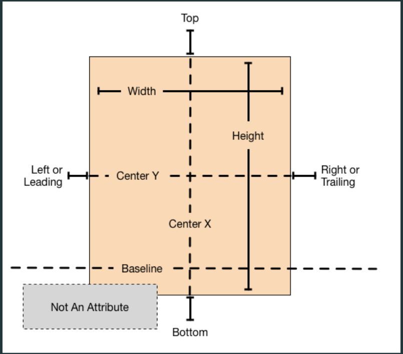


Layout and Geometry Management

From Containers to Layout Managers

Apple's Auto Layout (the gold standard?)

- Define objects, attributes, and relationships
- Attributes define constraints, the layout engine updates accordingly

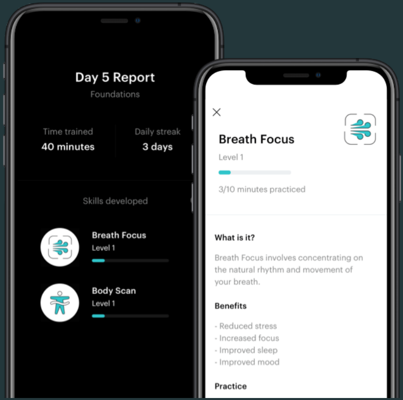


Why do we need layout?

Layout and Geometry Management

From Containers to Layout Managers

- Reduce code complexity
- Add flexibility to UI
- Visual appeal?
- **Usability**



Breath Focus involves concentrating on the natural rhythm and movement of your breath.

[balanceapp.com, 2021]

User Interface Layout Tools

User Interface Layout Tools

Managing Layout Graphically

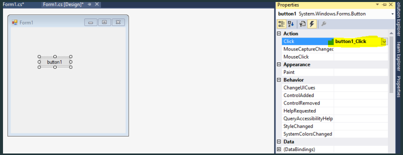
- Building layout and geometry managers is hard
- Writing code that uses layout managers is less hard, but hard

User Interface Layout Tools

Managing Layout Graphically

User Interface Tools...

- Support rapid prototyping (pre-coding)
- Reusability (can apply to multiple platforms)
- Add consistency across platforms
- Bring designers, developers, and researchers together through a single tool



button1 System.Windows.Forms.Button

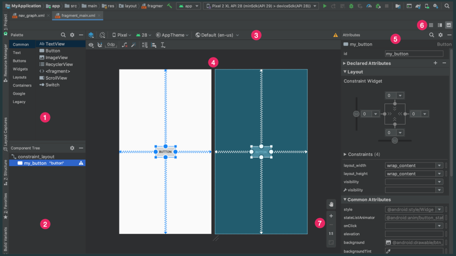
Click	button1_Click
MouseCaptureChangec	
MouseClick	
Paint	
ChangeUICues	
ControlAdded	
ControlRemoved	
HelpRequested	
QueryAccessibilityHelp	
StyleChanged	
SystemColorsChanged	
(DataBindings)	

User Interface Layout Tools

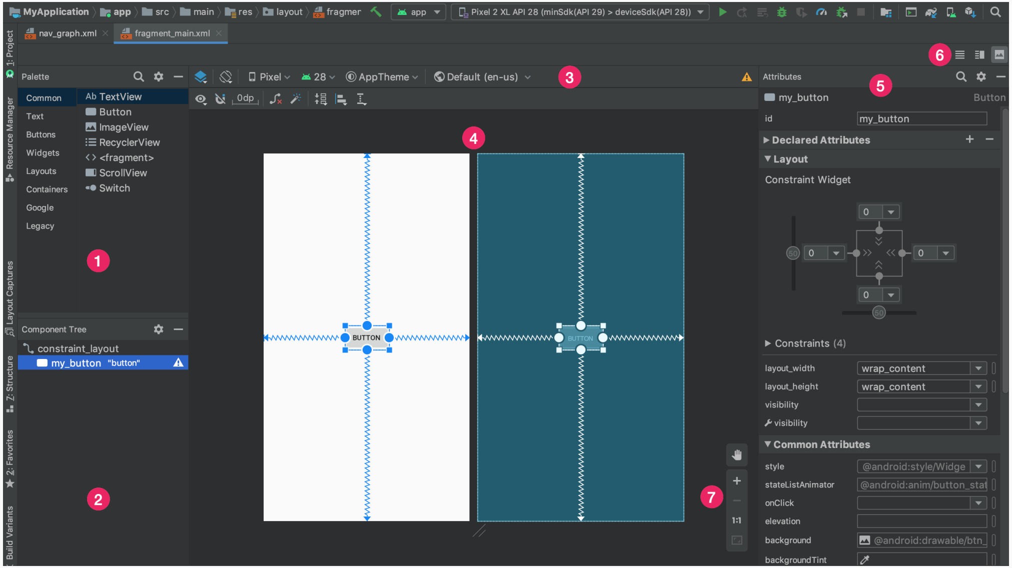
Managing Layout Graphically

User Interface Tools...

- Automate much of the coding process
- Replace programming steps with graphical configuration
- Lower level of expertise to create
- Raise level of reliability



[android.com, 2021]



id: my_button
layout_width: wrap_content
layout_height: wrap_content
visibility:
visibility:
style: @android:style/Widge
stateListAnimator: @android:anim/button_stat
onClick:
elevation:
background: @android:drawable/btn_
backgroundTint:

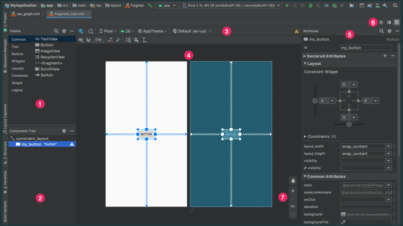
[android.com, 2021]

User Interface Layout Tools

Managing Layout Graphically

Lower the level of expertise and raise reliability...

- Make creating a UI easy and easy to use
- Invite non-programmers into the process
- Support validation
- Can drive important processes like undo, error recovery, and accessibility



[android.com, 2021]

User Interface Layout Tools

Some takeaways

- As computational systems evolve, so will UIs and the tools that we use to build them
- These types of tools are critical for building effective software interfaces
- How will we build for future user interfaces?

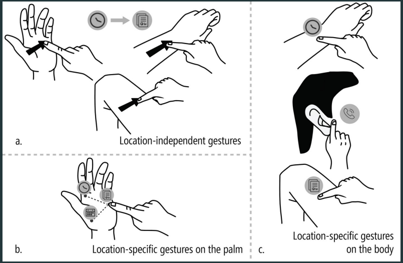
User Interface Layout Tools

Some takeaways

Future user interfaces?

- Wearables?
- Augmented Reality?
- Voice or Conversational agents?
- On Body, Eyewear?

You will answer these questions for A4 (coming soon;))


a.
Location-independent gestures
b.
Location-specific gestures on the palm
c.
Location-specific gestures on the body

QA and Assignment Discussion

References

References i

android.com (2021).
Layout editor.

balanceapp.com (2021).
Balance - personalized meditation.

Hudson, S. E. and Mohamed, S. P. (1990).
Interactive specification of flexible user interface displays.
ACM Trans. Inf. Syst., 8(3):269–288.

java2s.com (2021).
Jpanel « jscrollpane « java swing qa.

Wikipedia (2021a).
Composite pattern.

Wikipedia (2021b).
Decorator pattern.