



# TROUBLESHOOTING SHINY

# OUTLINE

- ▶ Writing robust code
- ▶ Debugging tools at your disposal
- ▶ Techniques for debugging

**Writing**

**robust code**

# WRITING ROBUST CODE

- ▶ Complexity is the problem; abstraction is the solution
  - ▶ Software programs are far too large to reason about in their entirety
  - ▶ Good programs are broken into fragments that you can reason about locally, and compose reliably
  - ▶ In other words, we break the program into simple fragments, and if we verify that each fragment is correct, then the whole program is correct
- ▶ **Are our fragments simple enough to understand?**
- ▶ **Do they compose reliably?**



# UNDERSTANDABLE FRAGMENTS

- ▶ Indent your code! (Ctrl+I/Cmd+I)
- ▶ Extract out complicated processing logic (as opposed to UI logic) into top-level functions so you can test them separately
- ▶ Each function, reactive, observer, or module should be small, and do one thing
  - ▶ Function/reactive/observer bodies that don't fit on a single screen is a bad code smell
  - ▶ If you're having trouble giving something a meaningful name, maybe it's doing too much
- ▶ When you encounter unavoidable complexity, at least try to firewall the complexity behind as simple/straightforward an API as possible
  - ▶ Even if it's hard to verify if the scary piece itself is correct, it's still easy to verify that its callers are correct

# RELIABLE COMPOSITION

- ▶ Prefer "pure functions"—functions without side effects. Much less likely to surprise you.
  - ▶ When you do need side effects, don't put them in surprising places. Consider following command-query separation—"asking a question should not change the answer"
- ▶ Reactive expressions must not have side effects
- ▶ Avoid observers and reactive values, where possible; use reactive expressions if you can help it
- ▶ Don't pass around environments and reactive values objects; this is similar to sharing global variables, it introduces hidden coupling
- ▶ For ease of reasoning, prefer: pure functional > reactive > imperative (observers)

# Debugging tools

# STANDARD R DEBUGGING TOOLS

- ▶ Tracing

- ▶ `print()/cat()/str()`
- ▶ `renderPrint` eats messages, must use `cat(file = stderr(), ...)`
- ▶ Also consider shinyjs package's **logjs**, which puts messages in the browser's JavaScript console

- ▶ Debugger

- ▶ Set breakpoints in RStudio
- ▶ `browser()`
- ▶ Conditionals: `if (!is.null(input$x)) browser()`



# SHINY DEBUGGING TOOLS

- ▶ **Symptom:** Outputs or observers don't execute when expected, or execute too often
- ▶ Reactlog
  - ▶ Restart R process
  - ▶ Set `options(shiny.reactlog = TRUE)`
  - ▶ In the browser, Ctrl+F3 (or Cmd+F3)
- ▶ Showcase mode: DESCRIPTION file or `runApp(display.mode = "showcase")`

# SHINY DEBUGGING TOOLS

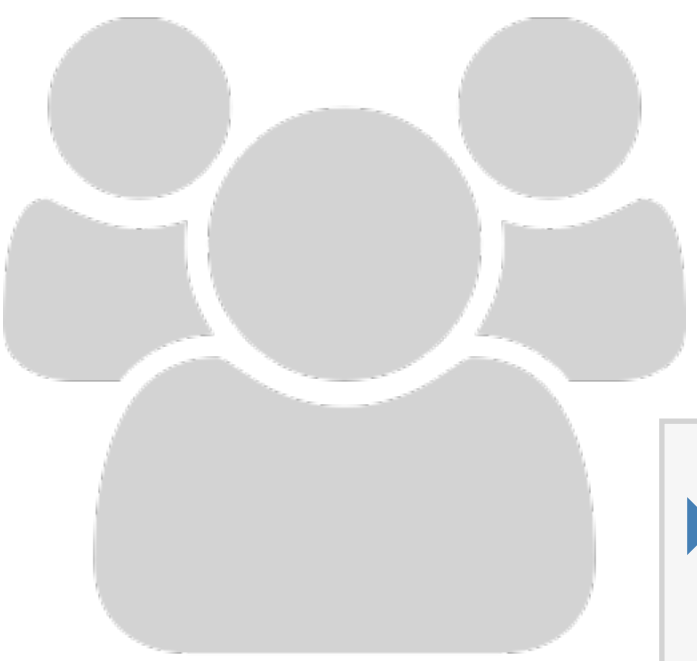
- ▶ **Symptom:** Red error messages in the UI *or* session abruptly terminates
- ▶ This means an R error has occurred
- ▶ Look in R console for stack traces
  - ▶ By default, Shiny hides "internal" stack traces. Use **`options(shiny.fullstacktrace = TRUE)`** if necessary to show.
- ▶ Newer versions of Shiny/Shiny Server "sanitize" errors, for security reasons (every error message is displayed as "An error has occurred")
  - ▶ See [sanitizing errors](#) article for more details, including how to view the real errors

# SHINY DEBUGGING TOOLS

- ▶ **Symptom:** Server logic seems OK, but unexpected/broken/missing results in browser
- ▶ Check browser's JavaScript console for errors
- ▶ Listen in on conversation between client and server
  - ▶ **`options(shiny.trace=TRUE)`** logs messages in the R console
  - ▶ Use Chrome's Network tab to show individual websocket messages

**Your turn**

# EXERCISE




- ▶ Open **movies\_broken\_01.R**. It is broken in a not-very-subtle way. See if you can find and fix the bug.
- ▶ Continue on for **movies\_broken\_02.R** through **movies\_broken\_04.R**.

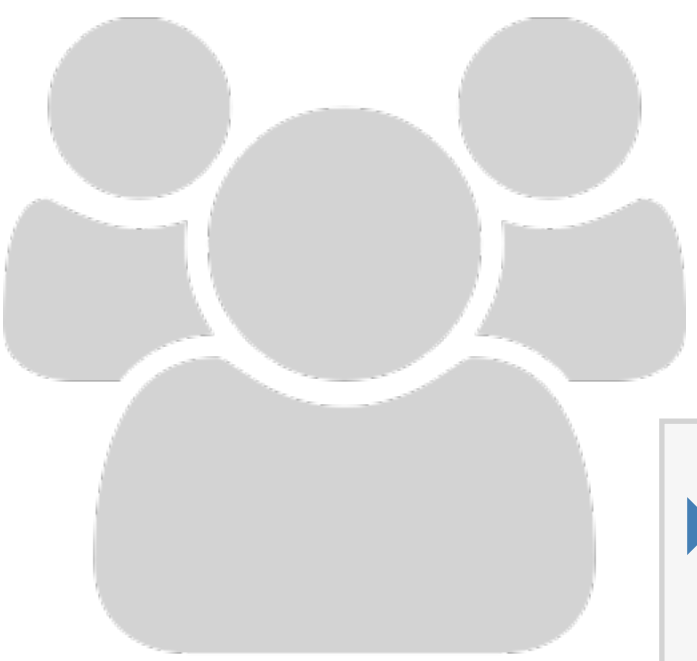
10<sub>m</sub> 00<sub>s</sub>



# SOLUTION

- 
- ▶ **movies\_broken\_01.R**: Missing commas, as explained in the R console
  - ▶ **movies\_broken\_02.R**: ggplot call was missing "+"
  - ▶ **movies\_broken\_03.R**: Reactive was not being called with "()"
  - ▶ **movies\_broken\_04.R**: Output ID was not consistent between UI and server

# EXERCISE



- ▶ Open **movies\_broken\_05.R**. It is broken in a subtle way. See if you can find and fix the bug.
  - ▶ Check the box for one other type of movie and see how the text about number of movies changes.
  - ▶ Choose a low sample size and get a new sample.
  - ▶ Choose a high sample size and get a new sample.

3<sub>m</sub> 00<sub>s</sub>



# SOLUTION

- ▶ **movies\_broken\_05.R**: With a low sample size there are not necessarily at least one of each type of movie, hence the way the paste function is written you get length coercion.

```
uiOutput(outputId = "n"),

output$n <- renderUI({
  types <- movies_sample()$title_type %>%
  factor(levels = input$selected_type)
  counts <- table(types)

  HTML(paste("There are",
             counts, input$selected_type,
             "movies in this dataset. <br>"))
})
```

**Common**

**errors**

# COMMON ERRORS

- ▶ "Object of type 'closure' is not subsettable"
  - ▶ You forgot to use () when retrieving a value from a reactive expression  
`plot(userData)` should be `plot(userData())`



# COMMON ERRORS

- ▶ "Unexpected symbol"
- "Argument xxx is missing, with no default"
- ▶ Missing or extra comma in UI. Sometimes Shiny will realize this and give you a hint, or use RStudio editor margin diagnostics.

# COMMON ERRORS

- ▶ "Operation not allowed without an active reactive context. (You tried to do something that can only be done from inside a reactive expression or observer.)"
- ▶ Tried to access an input or reactive expression from directly inside the server function. You must use a reactive expression or observer instead.
  - ▶ Or if you really *only* care about the value of that input at the time that the session starts, then use **isolate()**.

**More**

**resources**

# RESOURCES

- ▶ Debugging article on shiny.rstudio.com
- ▶ Jonathan McPherson's talk at Shiny Developer conference (video, slides)
- ▶ Hadley Wickham's *Advanced R* has a chapter on debugging





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