Lecture 09 – Debugging

Learning Objectives:

1. **Become proficient in the use of the R language**

   1.8 Learn the basics of debugging interactively and non-interactively in R.

3. **Learn the basic principles of software design.**

   3.6 Learn effective strategies for debugging code interactively and non-interactively.

   3.7 Practice defensive coding.

Debugging strategy

Hadley Wickham's Steps for Debugging (from *Advanced R*)

1. **Google it!** Googling will sometimes yield a solution.
    - Remove variable and function names
    - Read and understand the post, why the error occurs, and why the fix works.
    - Read a variety of posts to see if the fixes are consistent or if there are other options.

2. **Make it repeatable.** Form a hypothesis and test it until it works out.
    - Copy code into separate script and run it that way.
    - Create an automated test.

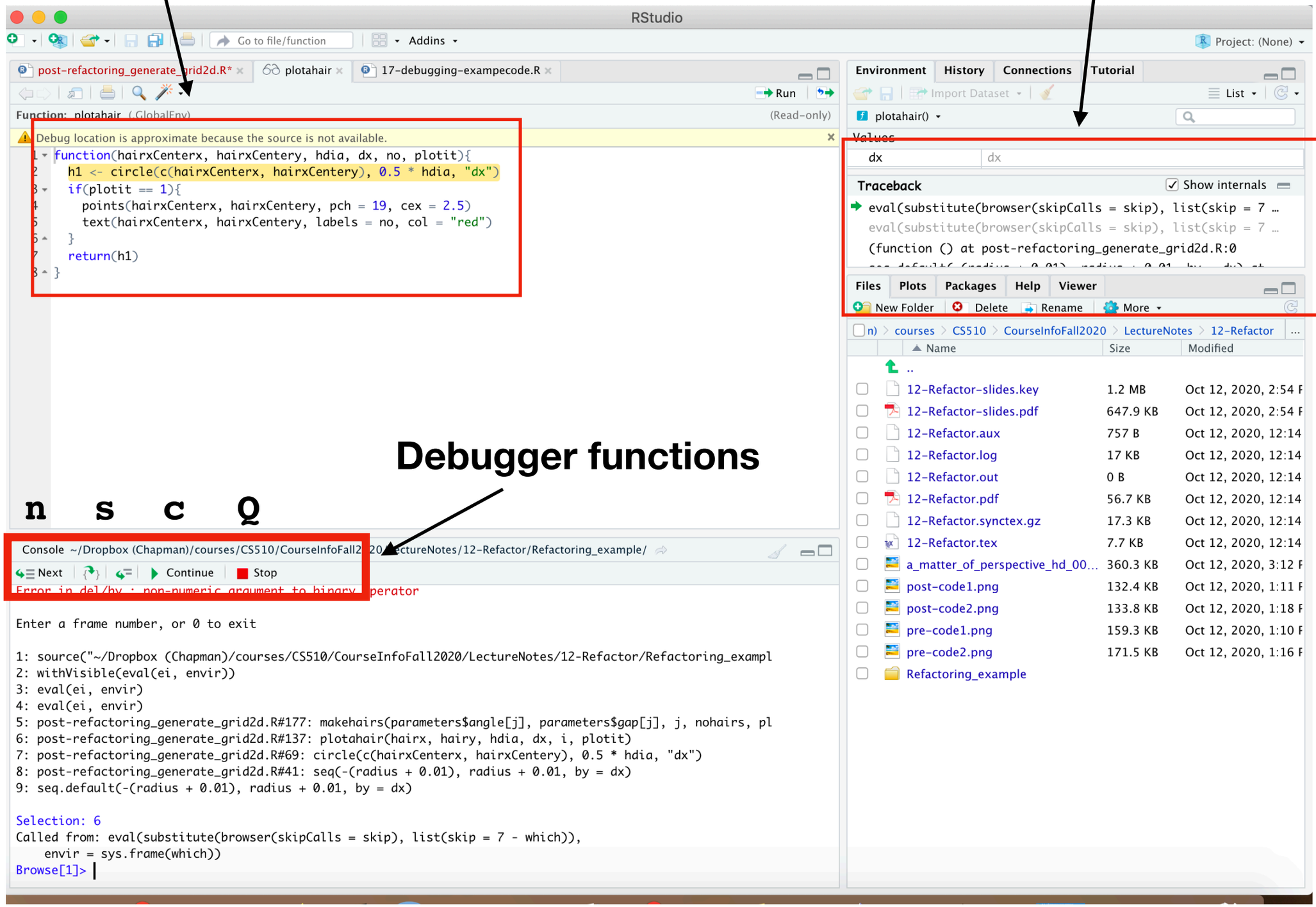
3. **Find out where it is.** Critical step to find where in the script the error originates.
    - Use traceback() to find error
    - For functions, define parameters manually and run line-by-line
    - For for loops, define your looped parameter and run line-by-line
    - There are tools!

4. **Fix it and test it.** Be sure to make the error a test!

Tools that will help: RStudio's debugger

Visualizing problems

`traceback()`



Non-interactive debugging

Stick with the general strategy, but there are fewer tools to help.

Check common problems:

- Did you run the code in a clean session?
- Is the working directory different?
- Is the path environment different?
- Is the `R_LIBS` path different?

Use `dump.frames()` (like `recover()` in interactive mode):

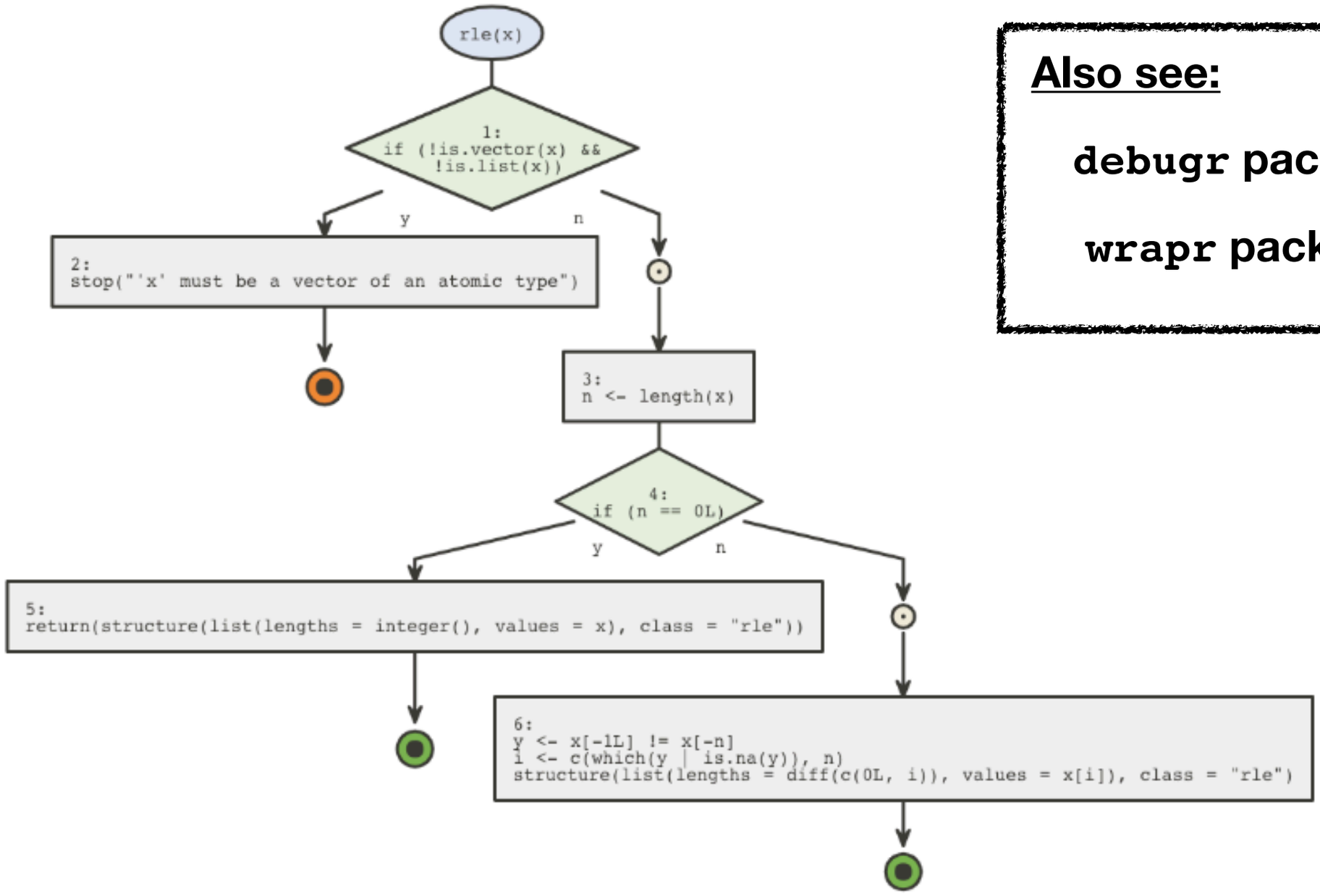
```
dump_and_quit <- function() {
    # Save debugging info to file las.dump.rda
    dump.frames(to.file = TRUE)
    # Quits R with error status
    q(status = 1)
}

options(error = dump_and_quit)
```

Tools that will help: `flow` package

To install: `remotes::install_github("moodymudskipper/flow")`

Draws flow charts of functions. Useful for a deep dive into analysis pipelines.

https://moodymudskipper.github.io/flow/articles/Draw-a-function.html



Also see:

`debugr` package

`wrapr` package

Defensive programming

“Fail fast.”

- Be strict about what you accept.

- Avoid functions that use non-standard evaluation.

- Avoid functions that return different types of output depending on their input.

Condition handling:

- `try()`

- `tryCatch()`

Additional Resources

https://adv-r.hadley.nz/debugging.html#non-interactive-debugging –
Debugging, *Advanced R*

https://data-flair.training/blogs/debugging-in-r-programming/ –
R Debug Essentials

https://support.rstudio.com/hc/en-us/articles/205612627-Debugging-with-RStudio –
Debugging with RStudio

https://rdrr.io/cran/wrapr/f/vignettes/DebugFnW.Rmd – wrapr Debug Vignette

https://cran.r-project.org/web/packages/debugr/vignettes/debugr.html –
debugr package vignette