

How do I find the bottleneck?

WRITING EFFICIENT R CODE



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Alice: "Where should I go?"

The Cheshire Cat: "That depends on where you want to end up."

Code profiling

The general idea is to:

- Run the code
- Every few milliseconds, record what is being currently executed
- `Rprof()` comes with R and does exactly this
 - Tricky to use
- Use **profvis** instead

IMDB data set

- From the `ggplot2movies` package

```
data(movies, package = "ggplot2movies")
dim(movies)
```

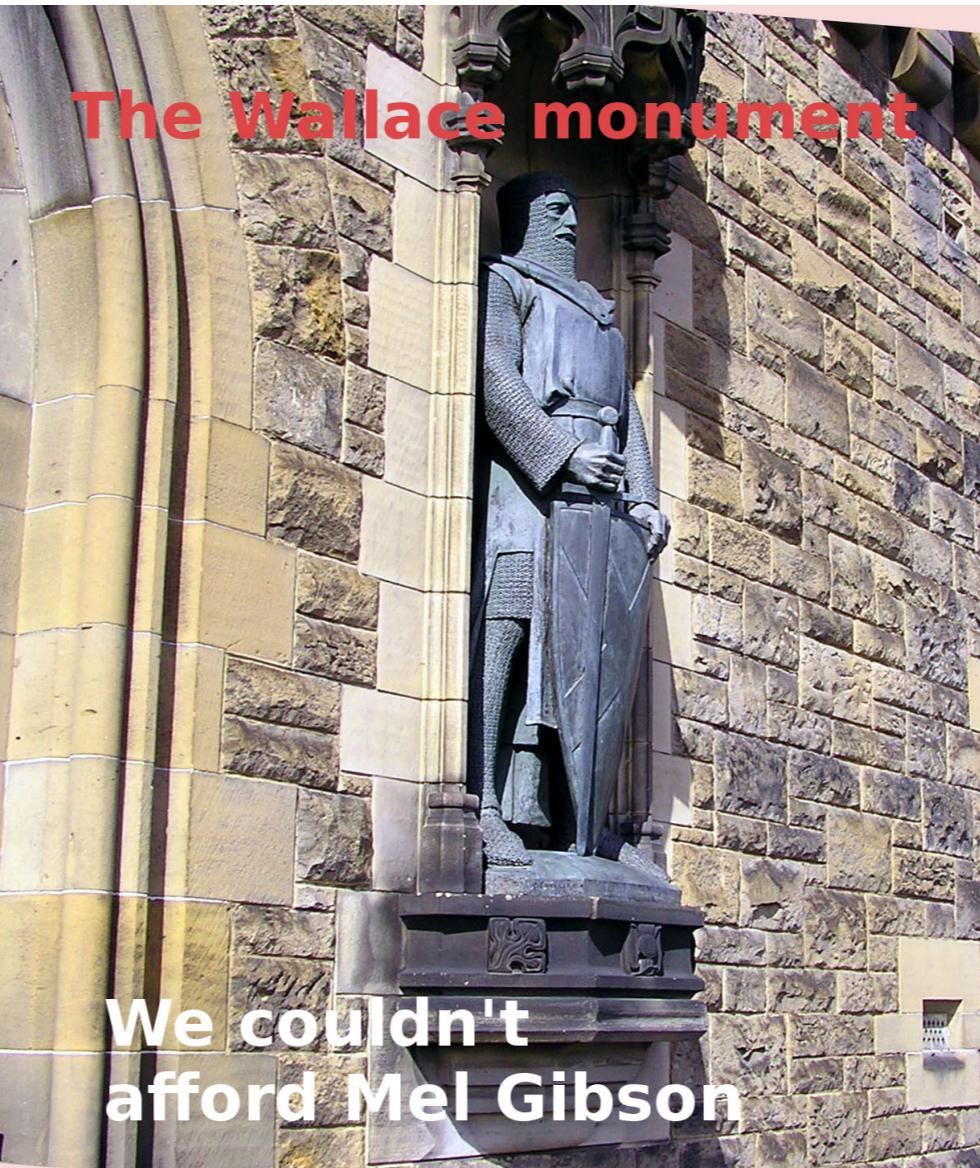
```
58788    24
```

- Data frame: around 60,000 rows and 24 columns
- Each row corresponds to a particular movie

Braveheart

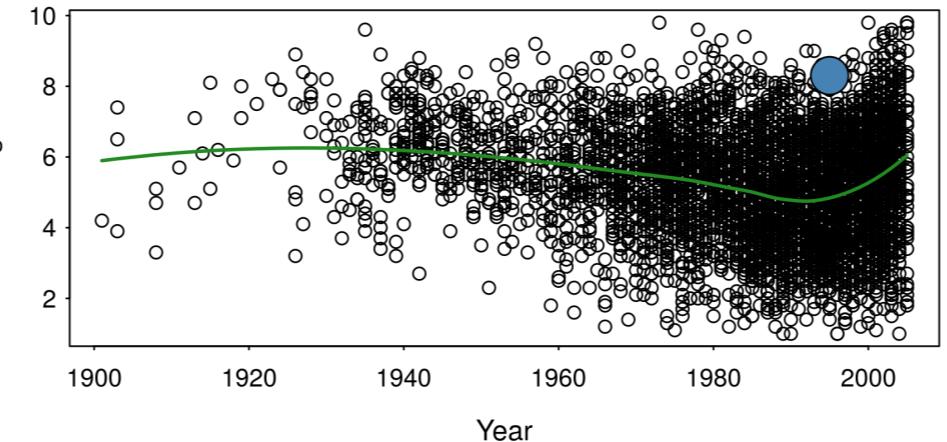
```
braveheart = movies[7288, ]
```

Year	Length	Rating
1995	177	8.3



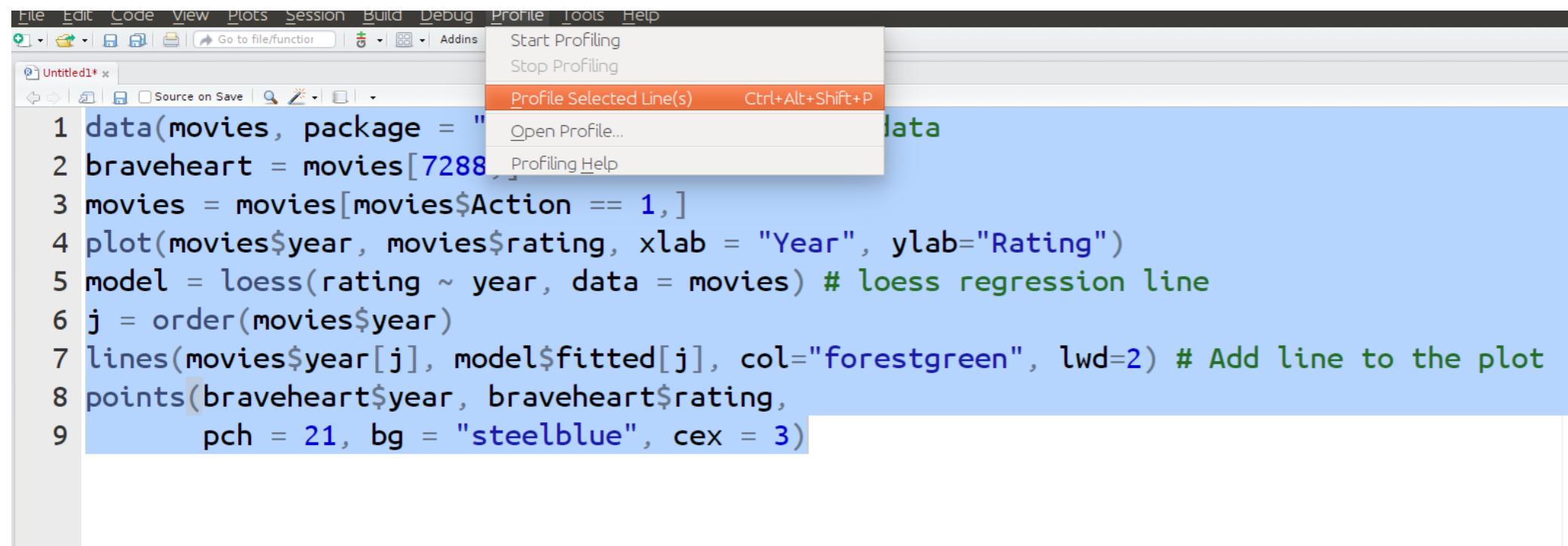
Example: Braveheart

```
# Load data
data(movies,
+     package = "ggplot2movies")
braveheart <- movies[7288,]
movies <- movies[movies$Action==1,]
plot(movies$year, movies$rating,
+     xlab = "Year", ylab = "Rating")
# local regression line
model <- loess(rating ~ year,
+                 data = movies)
j <- order(movies$year)
lines(movies$year[j],
+       model$fitted[j],
+       col = "forestgreen")
points(braveheart$year,
+       braveheart$rating,
+       pch = 21,
+       bg = "steelblue")
```



Profvis

- RStudio has integrated support for profiling with profvis
 - Highlight the code you want to profile
 - **Profile -> Profile Selected lines**



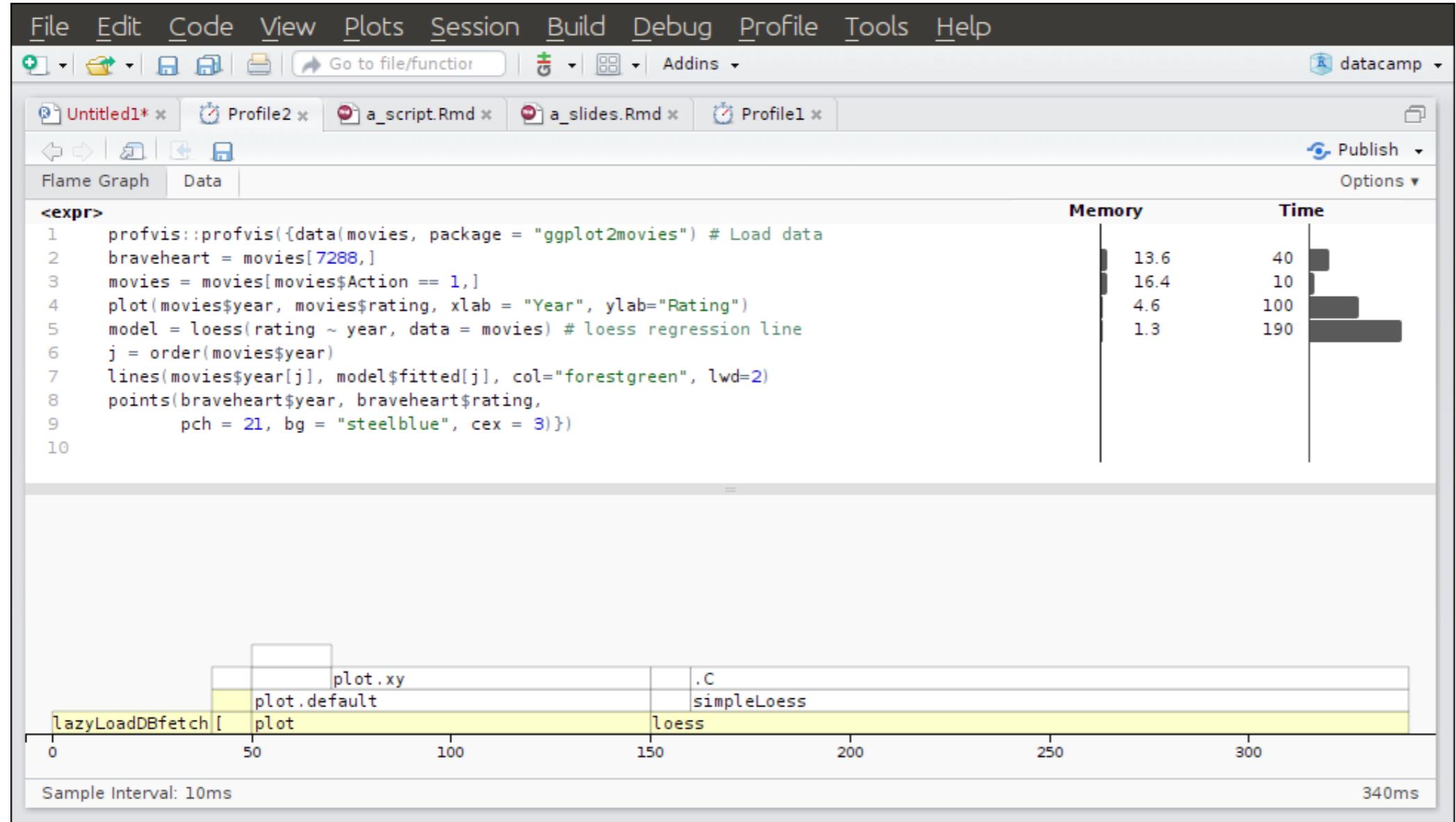
A screenshot of the RStudio interface. The top menu bar is visible with the 'Profile' option highlighted. A dropdown menu is open under 'Profile', showing options: 'Start Profiling', 'Stop Profiling', 'Profile Selected Line(s) Ctrl+Alt+Shift+P' (which is highlighted in orange), 'Open Profile...', and 'Profiling Help'. Below the menu, a code editor window displays R code. Lines 1 through 9 are shown, with line 1 being the first line of the script. The code performs operations like loading a dataset, filtering it for action movies, plotting rating vs year, and adding a loess regression line.

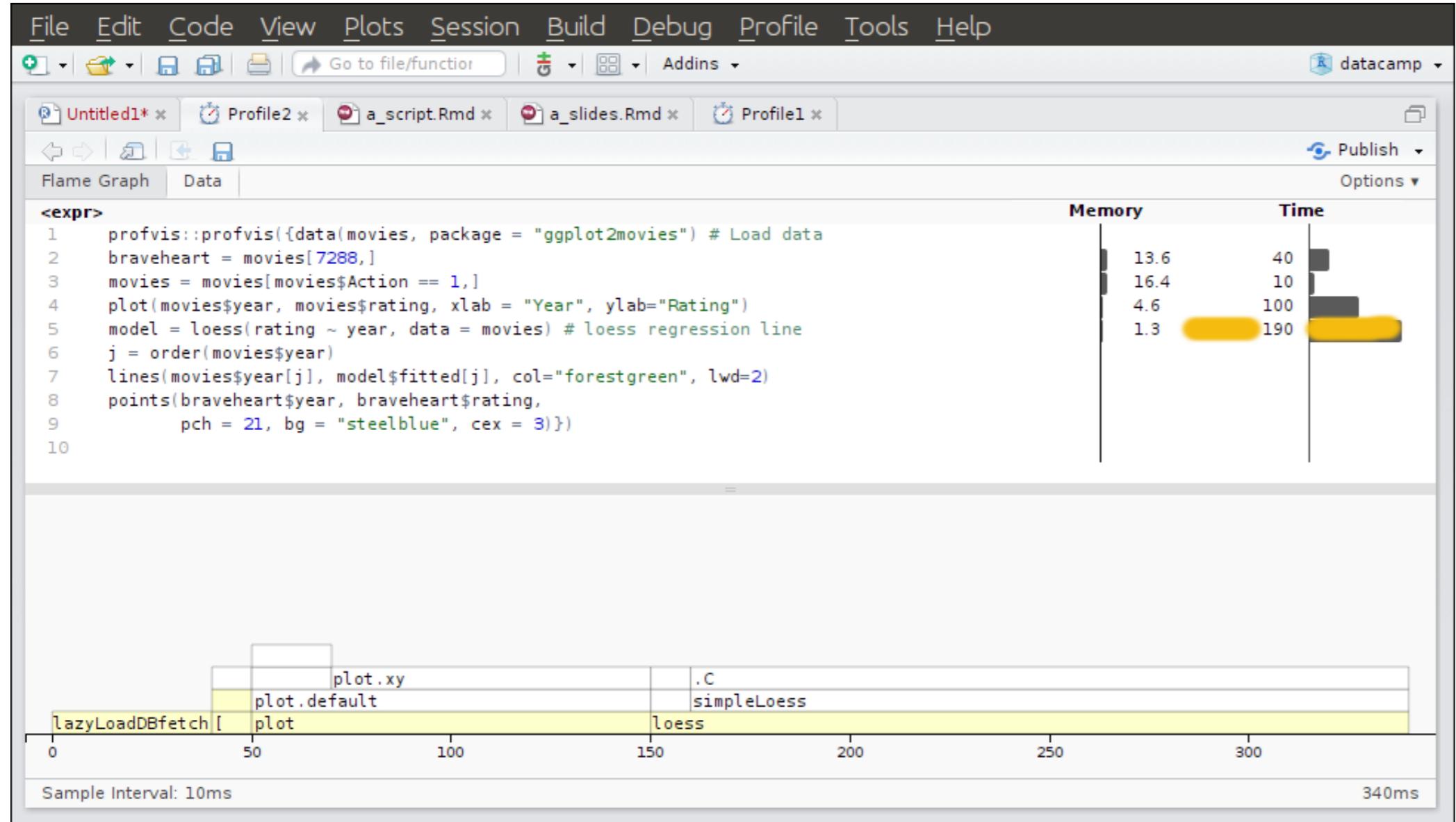
```
1 data(movies, package = "ggplot2")
2 braveheart = movies[7288, ]
3 movies = movies[movies$Action == 1, ]
4 plot(movies$year, movies$rating, xlab = "Year", ylab="Rating")
5 model = loess(rating ~ year, data = movies) # loess regression line
6 j = order(movies$year)
7 lines(movies$year[j], model$fitted[j], col="forestgreen", lwd=2) # Add line to the plot
8 points(braveheart$year, braveheart$rating,
9   pch = 21, bg = "steelblue", cex = 3)
```

Command line

```
library("profvis")
profvis({
+ data(movies, package = "ggplot2movies") # Load data
+ braveheart <- movies[7288, ]
+ movies <- movies[movies$Action == 1, ]
+ plot(movies$year, movies$rating, xlab = "Year", ylab="Rating")
+ model <- loess(rating ~ year, data = movies) # loess regression line
+ j <- order(movies$year)
+ lines(movies$year[j], model$fitted[j], col="forestgreen", lwd=2)
+ points(braveheart$year, braveheart$rating,
+         pch = 21, bg = "steelblue", cex = 3)
+ })
```

Which line do you think will be the slowest?





Let's practice!

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Profvis

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Monopoly

- 40 squares
 - 28 properties (22 streets + 4 stations + 2 utilities)
 - Players take turns moving by rolling dice
 - Buying properties
 - Charging other players
 - Sent to jail: three consecutive doubles in a single turn

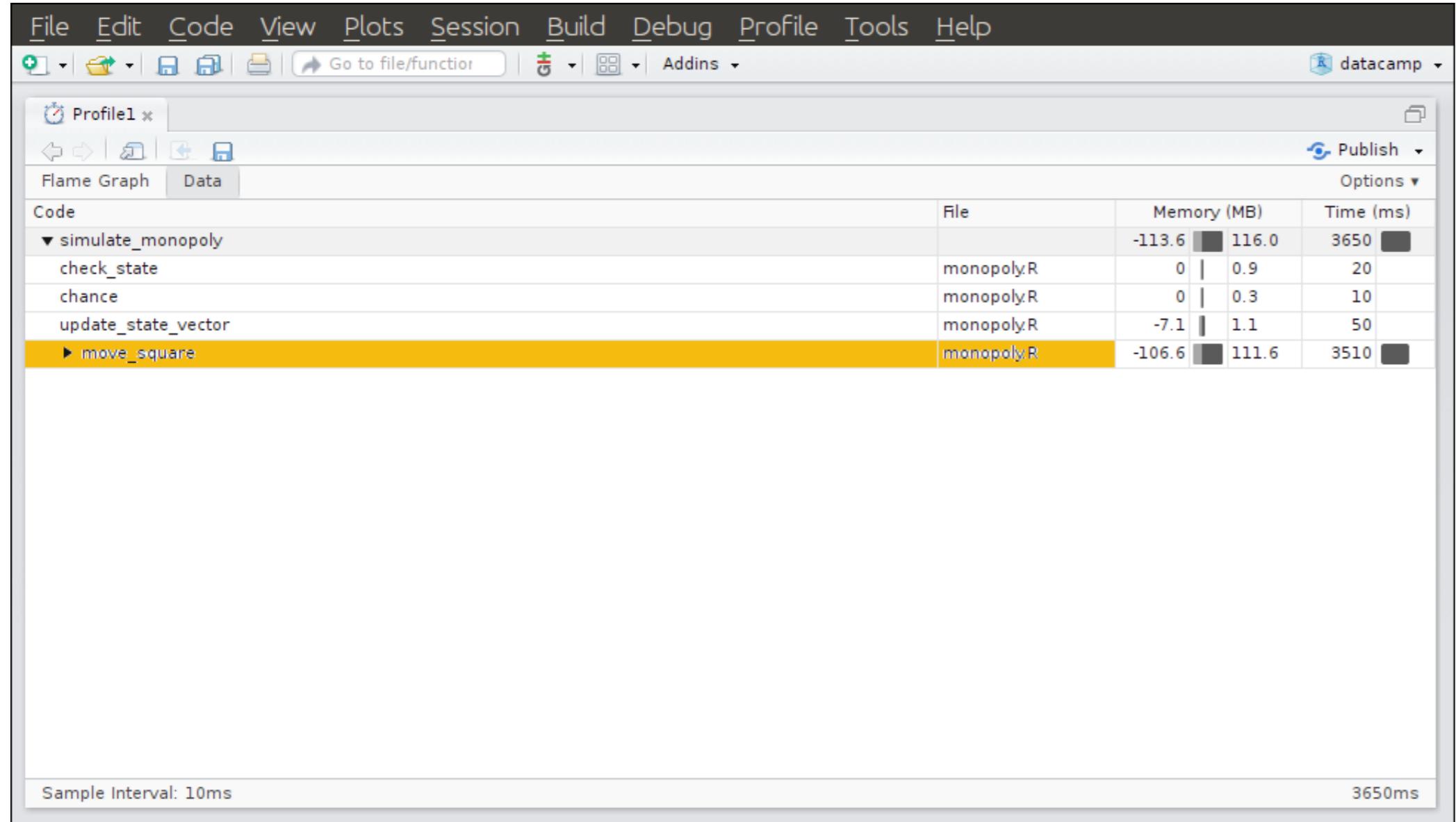


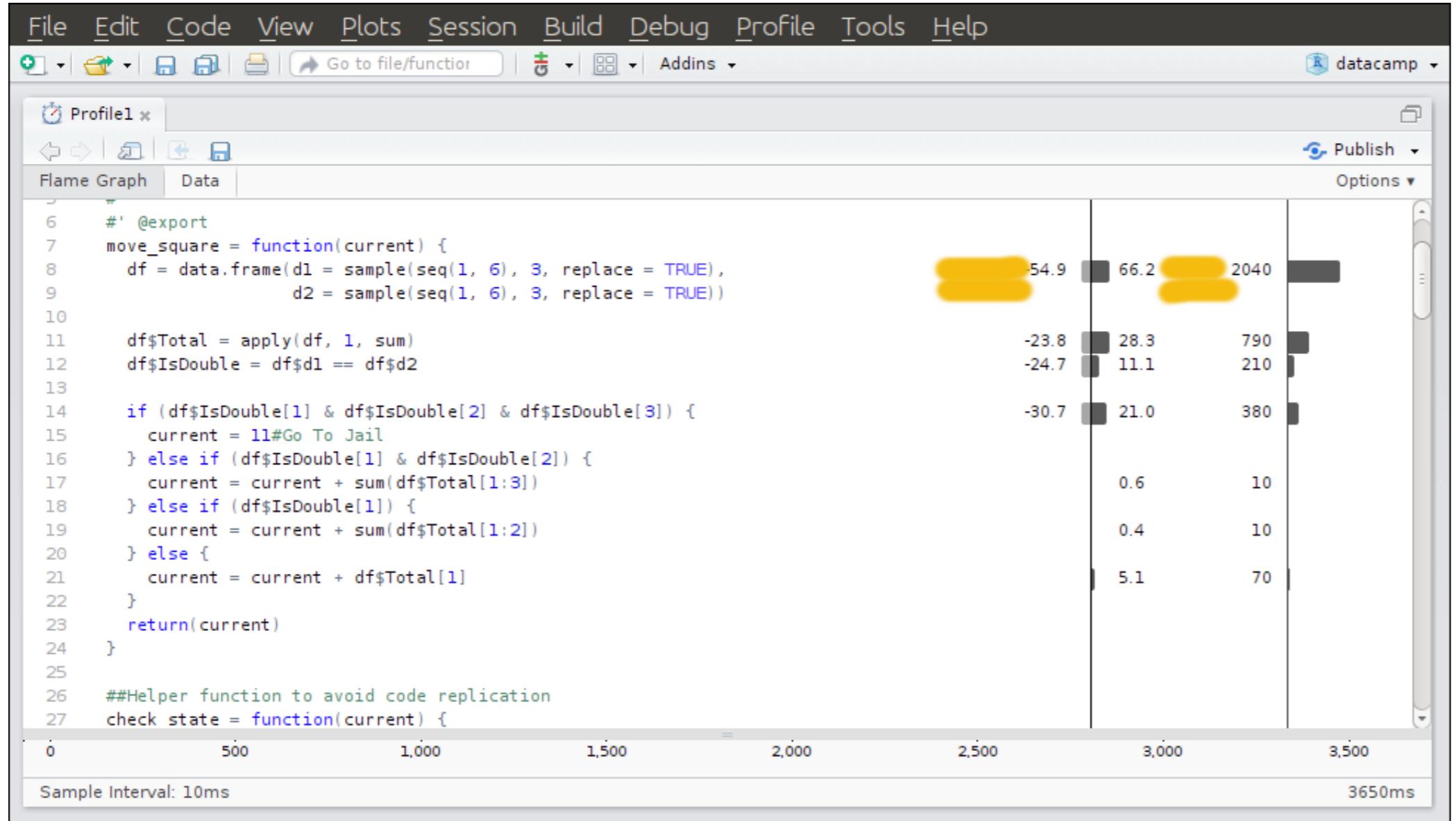
Monopoly Code

- Around 100 lines of code
 - Simplified game
 - Reject the capitalist system: no money
 - No friends, only 1 player
 -

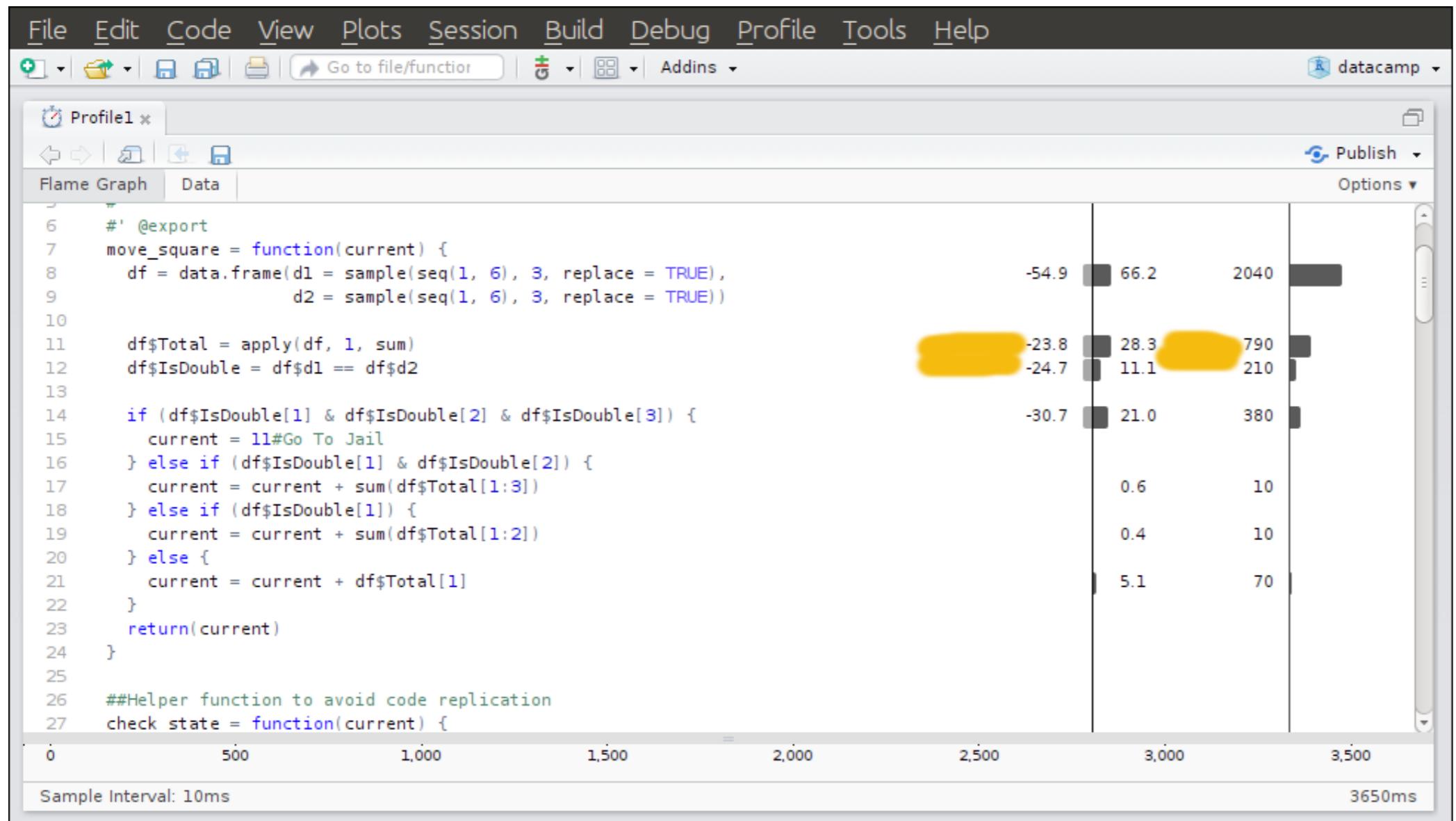


```
simulate_monopoly(no_of_r
```





Monopoly profvis



Let's practice!

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Monopoly recap

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Data frames vs matrices

```
# Original  
rolls <- data.frame(d1 = sample(1:6, 3, replace = TRUE),  
+                      d2 = sample(1:6, 3, replace = TRUE))
```

```
# Updated  
rolls <- matrix(sample(1:6, 6, replace = TRUE), ncol = 2)
```

- Total Monopoly simulation time: 2 seconds to 0.5 seconds
- Creating a data frame is slower than a matrix
- In the Monopoly simulation, we created 10,000 data frames

apply vs rowSums

```
# Original  
total <- apply(df, 1, sum)
```

```
# Updated  
total <- rowSums(df)
```

- 0.5 seconds to 0.16 seconds - 3 fold speed up

& vs &&

```
# Original  
is_double[1] & is_double[2] & is_double[3]
```

```
# Updated  
is_double[1] && is_double[2] && is_double[3]
```

- Limited speed-up
- 0.16 seconds to 0.15 seconds

Overview

Method	Time (secs)	Speed-up
Original	2.00	1.0
Matrix	0.50	4.0
Matrix + rowSums	0.20	10.0
Matrix + rowSums + &&	0.19	10.5

Let's practice!

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