

Visualizing the Collatz sequence

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Based on [a reddit post](#):

```
library(wolframR)
library(ggplot2); theme_set(theme_classic())

## Warning: package 'ggplot2' was built under R version 3.3.2

library(plyr)
library(dplyr)
```

```
set.seed(101)
n <- sample(1e7, 2000)

collatz_test <- function(x){
  ifelse(x %% 2 == 0,
    x/2,
    ifelse(x == 1, NA, 3 * x + 1)
  )
}

collatz_seq <- n %>%
  nest_while(collatz_test, any(!is.na(x)), m = "all")

collatz_list <- do.call("rbind", collatz_seq) %>%
  split(rep(1:ncol(.), each = nrow(.))) %>%
  lapply(function(x) rev(x[!is.na(x)]))

convert_collatz <- function(x, c = 0.4, h = 0.8, a = 1.5){
  list(
    theta = c * (h - 2 * (x %% 2)),
    length = x/(1+x^a)
  )
}

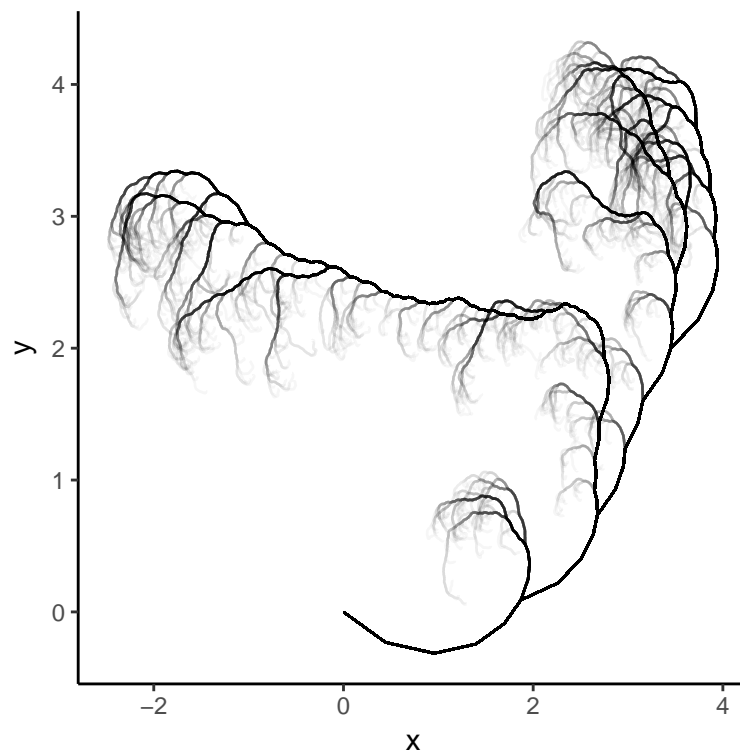
collatz_angle <- collatz_list %>%
```

```

lapply(convert_collatz) %>%
lapply(function(x){
  args <- x
  args$plot <- FALSE
  res <- do.call("angle_path", args)
}) %>%
bind_rows(.id = "run")

ggplot(collatz_angle, aes(x, y, group = run)) +
  geom_path(alpha = 0.04)

```



We can make things slightly fancier:

```

collatz_angle2 <- collatz_list %>%
  lapply(function(x){
    data.frame(level = 1/length(x) * 0:length(x))
  }) %>%
  bind_rows %>%
  cbind(collatz_angle) %>%
  as_data_frame

```

```
collatz_theme <- theme(
  panel.background = element_rect(fill = "black",
    colour = "black"),
  plot.margin = unit(c(0, 0, 0, 0), "in"),
  axis.ticks = element_blank(),
  axis.ticks.length = unit(0, "null"),
  axis.title = element_blank(),
  axis.text = element_blank(),
  panel.grid = element_blank(),
  panel.border = element_blank(),
  legend.position = "none"
)

ggplot(collatz_angle2, aes(x, y, group = run)) +
  geom_path(aes(col = level), lwd = 0.15, alpha = 0.07) +
  scale_colour_gradientn(
    colours = c("#89505C", "#2F3665", "#E4DD7C")) +
  collatz_theme
```

