

1. Let's create some aRt!

- (a) Install the **aRtsy** package. Provide the code in an R chunk that does not run. You only need to install it one time.

Solution:

```
# Code to install the aRtsy package  
install.packages("aRtsy")
```

- (b) Load the **aRtsy** package. Provide the code in an R chunk that does run. We need to load the library each time it is run.

Solution:

```
library(aRtsy)
```

- (c) Running `demo("aRtsy")` or `vignette("aRtsy")` don't return any helpful demos or tutorials. However, if you run `help("aRtsy")` you will find a link to a tutorial. Recreate the first figure they make using `canvas_collatz()`. Make sure to update the caption.

Solution:

```
# help("aRtsy")  
set.seed(1)  
canvas_collatz(colors = colorPalette("tuscan3"))
```



Figure 1: Recreation of the Collatz Conjecture from the Tutorial with Random Seed 1

- (d) Change the randomization seed to 1313, which will change the random numbers generated to create the plot. Can you see the difference? Make sure to update the caption.

Solution:

```
set.seed(1313)  
canvas_collatz(colors = colorPalette("tuscan3"))
```



Figure 2: Collatz Cojecture with Random Seed 1313

- (e) Now, create a new Collatz conjecture plot by specifying the following arguments. Note you will find the help file for the `canvas_collatz()` function to be rather helpful. Make sure to update the caption.
- Use the `vrolik4` color palette. Note you can find other by running `?colorPalette` in the console.
 - Make the background grey. Note a hexcode for grey is `#dbdbdb`.
 - Specify that there should be 72 strands.
 - Specify the angle used for bending the sequence for odd numbers as `-0.05`.
 - Specify the angle used for bending the sequence for even numbers as `0.0145` (note this is the default).

Solution:

```
canvas_collatz(
  colors = colorPalette("vrolik4"),
  background = "#dbdbdb",
  n = 72,
  angle.even = 0.0145,
  angle.odd = -.05,
  side = FALSE)
```

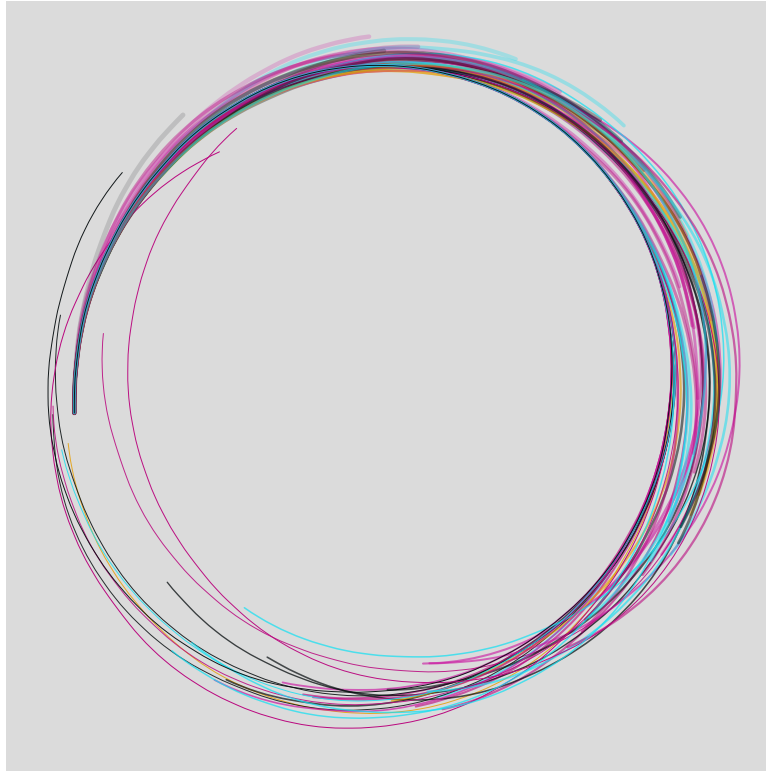


Figure 3: Collatz Conjecture with Grey Background, 72 strands, and the Color Palette vrolki4

- (f) Make another plot using the tutorial – feel free to be creative here! Note that I leave creating the R chunk and figure environment to you here. Make sure that your code is well-formatted and your plot is appropriately scaled.

Solution:

```
canvas_flame(
  colors = colorPalette("neo3"),
  background = "#000000",
  iterations = 1000000,
  variations = 21,
  symmetry = 3,
  blend = TRUE,
  weighted = FALSE,
  post = FALSE,
  final = FALSE,
  extra = FALSE,
  display = c("colored", "logdensity"),
  zoom = 1.8,
  resolution = 1000,
  gamma = 1
)
```

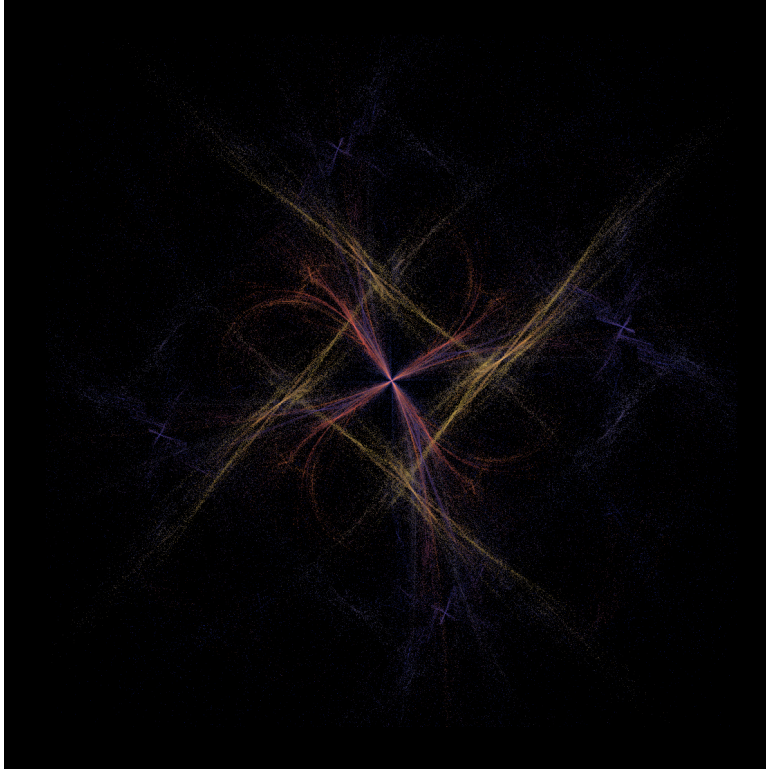


Figure 4: Fractal Flames Plot Using Color Palette neo3 and the Rings Variation.

- (g) Use `citation()` to get the BiBTeX citation for the `aRtsy` package and use `\citep{}` to add a parenthetical citation to the end of the sentence below.

Solution: We created the generative art in Question 1 using the `aRtsy` package for R. (Derks, 2024)

References

Derks, K. (2024). *aRtsy: Generative Art with 'ggplot2'*. R package version 1.0.0.

2. Suppose we wanted to solve $2^{x+1} + 2^{x-1} = 40$ for x . While this is a pretty straightforward algebra problem, it's useful for demonstrating the use of objects in R.

- (a) Create a numeric vector containing the integers from 0 to 10 inclusive. Hint – the solution to this problem is one of these values.

Solution:

```
#initial sequence
seq.1=(0:10)

seq.1

## [1] 0 1 2 3 4 5 6 7 8 9 10
```

- (b) Complete the algebra to compute $2^{x+1} + 2^{x-1}$ for each value in the numerical vector created in step 1. Make sure to save the result to a new numeric vector.

Solution:

```
#sequence after algebra
seq.2 = 2^(seq.1+1) + 2^(seq.1-1)

seq.2

## [1] 2.5 5.0 10.0 20.0 40.0 80.0 160.0 320.0 640.0 1280.0
## [11] 2560.0
```

- (c) Use the which() function to ask which result is 40.

Solution:

```
which(seq.2 == 40)

## [1] 5
```

- (d) What is the solution? That is, what value of x yields $2^{x+1} + 2^{x-1} = 40$?

Solution:

```
4
```

- (e) Explain why this approach wouldn't work for something like $3^{x+2} + 5(3^x) = 84$ where the solution is $x \approx 1.6309$.

Solution:

```
The number 84 will not be in the sequence of seq.2 so it cannot calculate a result because it is not
using algebra but simply looking for it in the sequence.
```