

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:**

```
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:**

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



Figure 1: Collatz Conjecture

- (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:** Yes, there are some small differences. The main one I notice is that this figure is shifted quite a bit to the right in relation to the previous figure.

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



Figure 2: Collatz Conjecture with 1313 seed

- (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 `vrolrik4` 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("vrolrik4"),
  background = "#dbdbdb",
  n = 72,
  angle.even = -0.05,
  angle.odd = 0.0145,
  side = FALSE
)
```

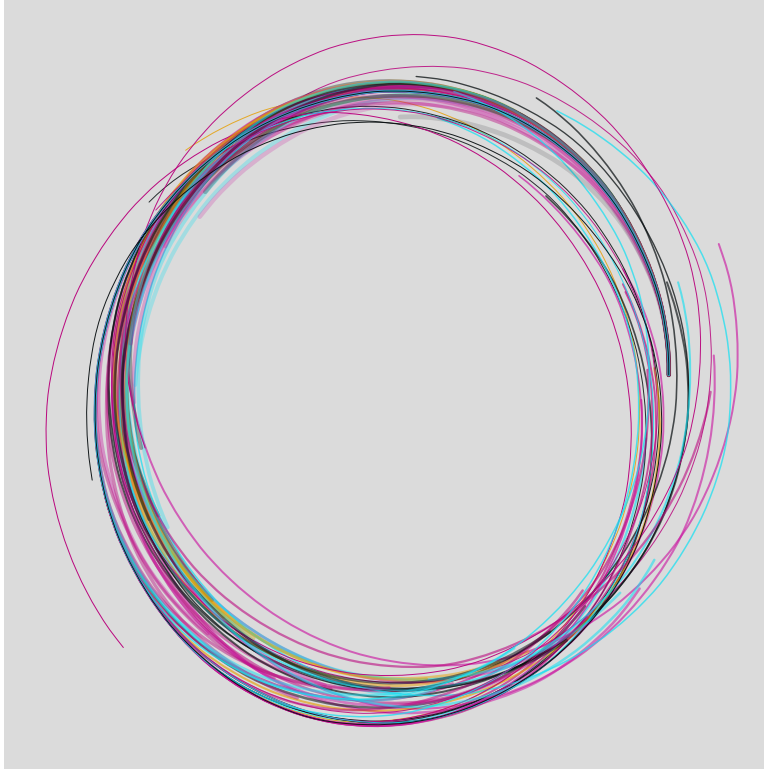


Figure 3: Vrolik4 Collatz Conjecture

- (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:**

```
set.seed(6)
canvas_flame(colors = colorPalette("kpd"),
             background = "#dbdbdb",
             iterations = 1000000,
             variations = 11,
             symmetry = -4,
             blend = TRUE,
             weighted = FALSE,
             post = FALSE,
             final = FALSE,
             extra = FALSE,
             display = c("colored", "logdensity"),
             zoom = 1,
             resolution = 1000,
             gamma = 2
)
```

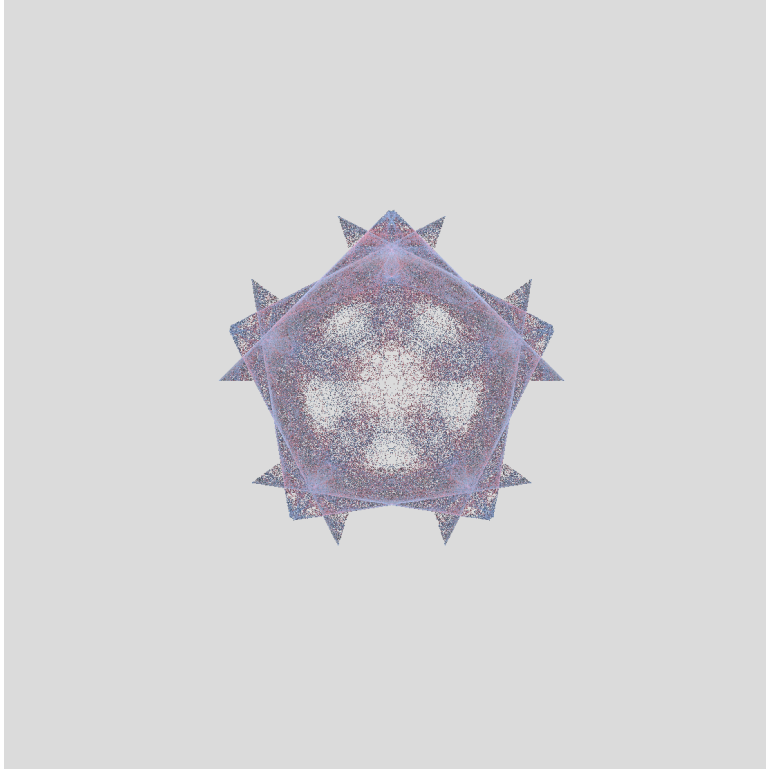


Figure 4: Diamond Fractal Flame

- (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 `aRtsypackage` for `R` (Derks, 2024).

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:**

```
## [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:**

```
## [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:**

```
## [1] 5
```

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

**Solution:** The `which()` function told us that the fifth element of the vector yields 40. The fifth element of our vector of integers is 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:** This approach wouldn't work because our original vector is a vector of integers from 0 to 10. 1.6309 is not an integer, so we wouldn't even get 84 in our new vector that computes the algebraic equation.

## References

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