BlackPink (Manifold Raymarching Rendering Engine)

"A Blazing 100x100px at 10FPS"

(we had to name it that because Joel likes naming things after pop artists.)

Objective

Can we use raymarching to render primitive objects inside an arbitrary manifold in real time?

“Non-euclidean rendering” in the most generalised form possible.

Raymarching

- an approximate and fast form of ‘raytracing’
- good for primitives (spheres, boxes et cetera.)
- still very expensive

Manifolds

Only one of us does galaxy brain maths.

Tech Stack Requirements

- Fast, compiled code
- We are relatively familiar with it (that disqualifies any *modern* or “good” language, and C++)
- Need n-dimensional vectors
- Need to draw pixels on a window
- not Java

C and libSDL2

Its fast (to run) and we “know” it. C is a nice language if only for the simplicity of its mental model.

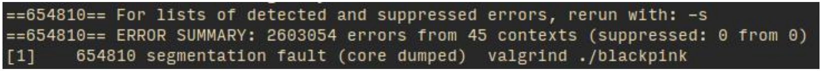
libSDL2 is what the big kids like Valve use.

- nicely handles threading, drawing, timers, and gets out of the way.

Richal spent 10 hours writing a vector library from scratch.

N-dimentional determinants and cross products *sound* simple.

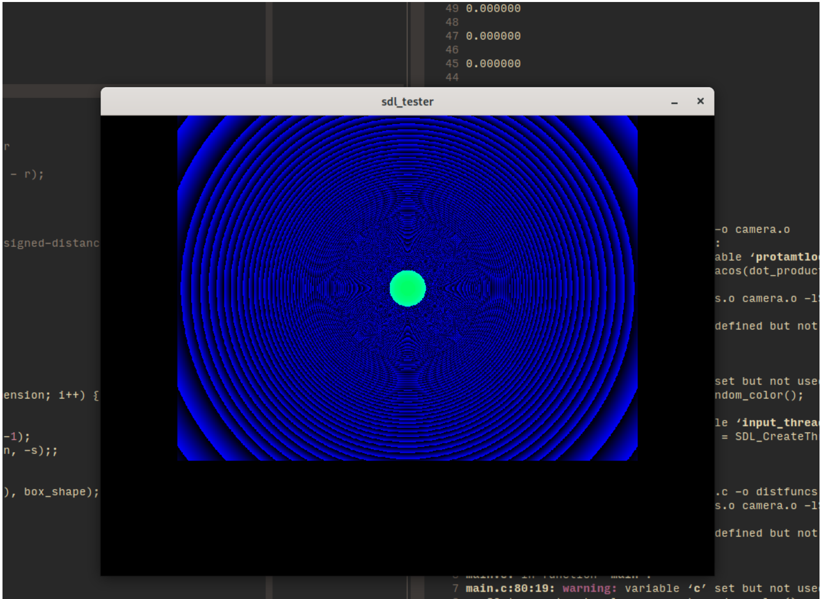
At one point we were leaking memory at approximately 150Mb per second.



```
==654810== For lists of detected and suppressed errors, rerun with: -s
==654810== ERROR SUMMARY: 2603054 errors from 45 contexts (suppressed: 0 from 0)
[1]    654810 segmentation fault (core dumped)  valgrind ./blackpink
```

Figure 1: lots of vagrind errors

The first success was 1pm on saturday, where we got a circle drawn to the screen.



```
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signed-distanc

ension; i++) {

-1);
n, -s);;

), box_shape);
```

```
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0.000000

0.000000
```

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:
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acos(dot_produc

s.o camera.o -l

defined but not


set but not use
ndom_color();

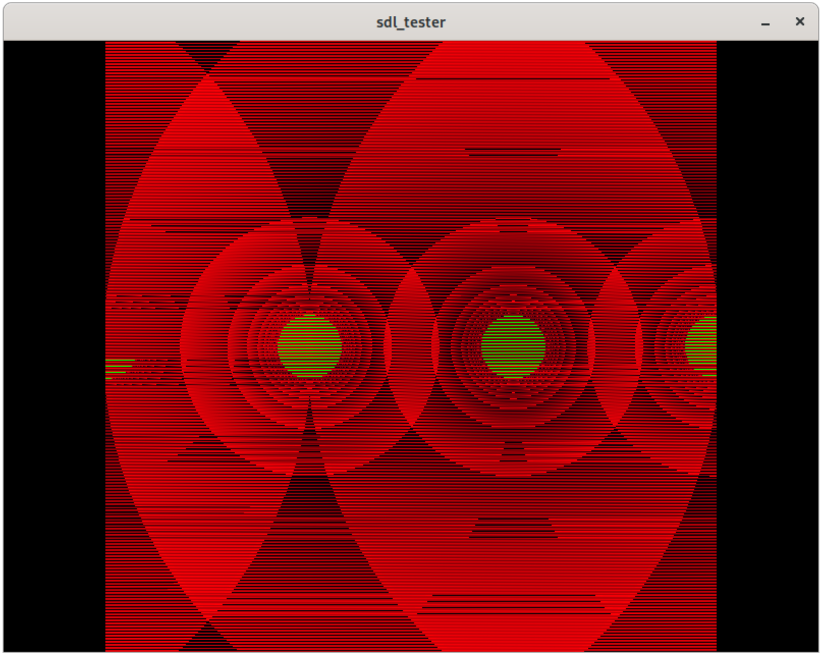
le ‘input_threa
 = SDL_CreateTh


.c -o distfuncs
s.o camera.o -l

defined but not

main.c:80:19: warning: variable ‘c’ set but not use
```

Fail states were often interesting.



Results

video? image? demo?

Takeaways 1

- sticking raymarching vectors to manifolds in 4 dimensions is possible but has a lot of edge cases

Takeaways 2

- having RAII would be really nice when writing a vector library

```
if (1 || keyboardstate[SDL_SCANCODE_UP]) {
    struct ray cameraray = {.pos = copy_vec(camera->pos
    manifoldturn(&cameraray, camera->x, 0);
    free_vec(cameraray.pos);

    cameraray.pos = copy_vec(camera->pos);
    manifoldturn(&cameraray, camera->y, 0);
    free_vec(cameraray.pos);

    cameraray.pos = camera->pos;
    manifoldstep(&cameraray, dist);
    free_vec(cameraray.pos);
}
```