The Mathfest 2009 Poster Image, Mathematical Art, Design and Education in Second Life

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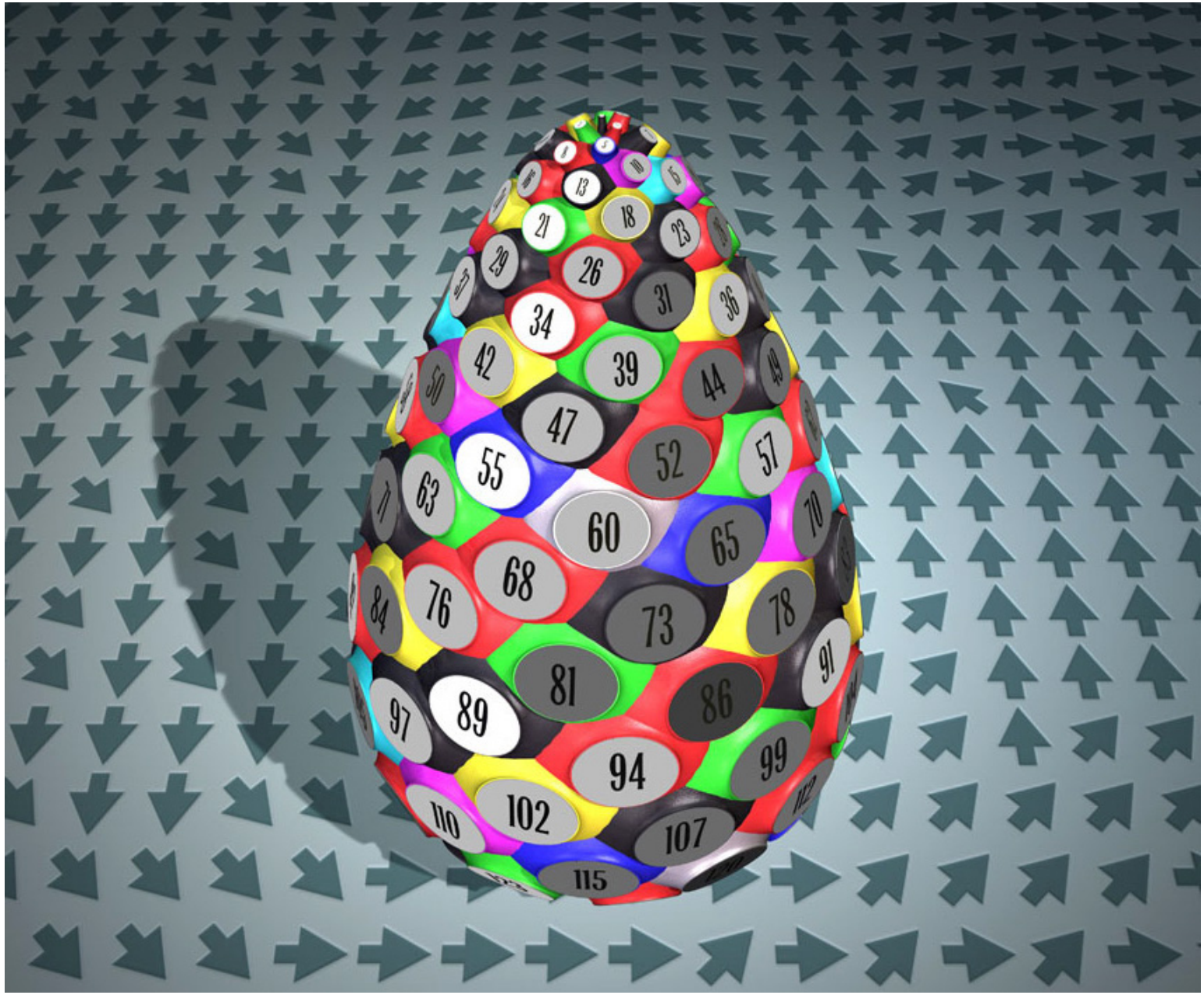
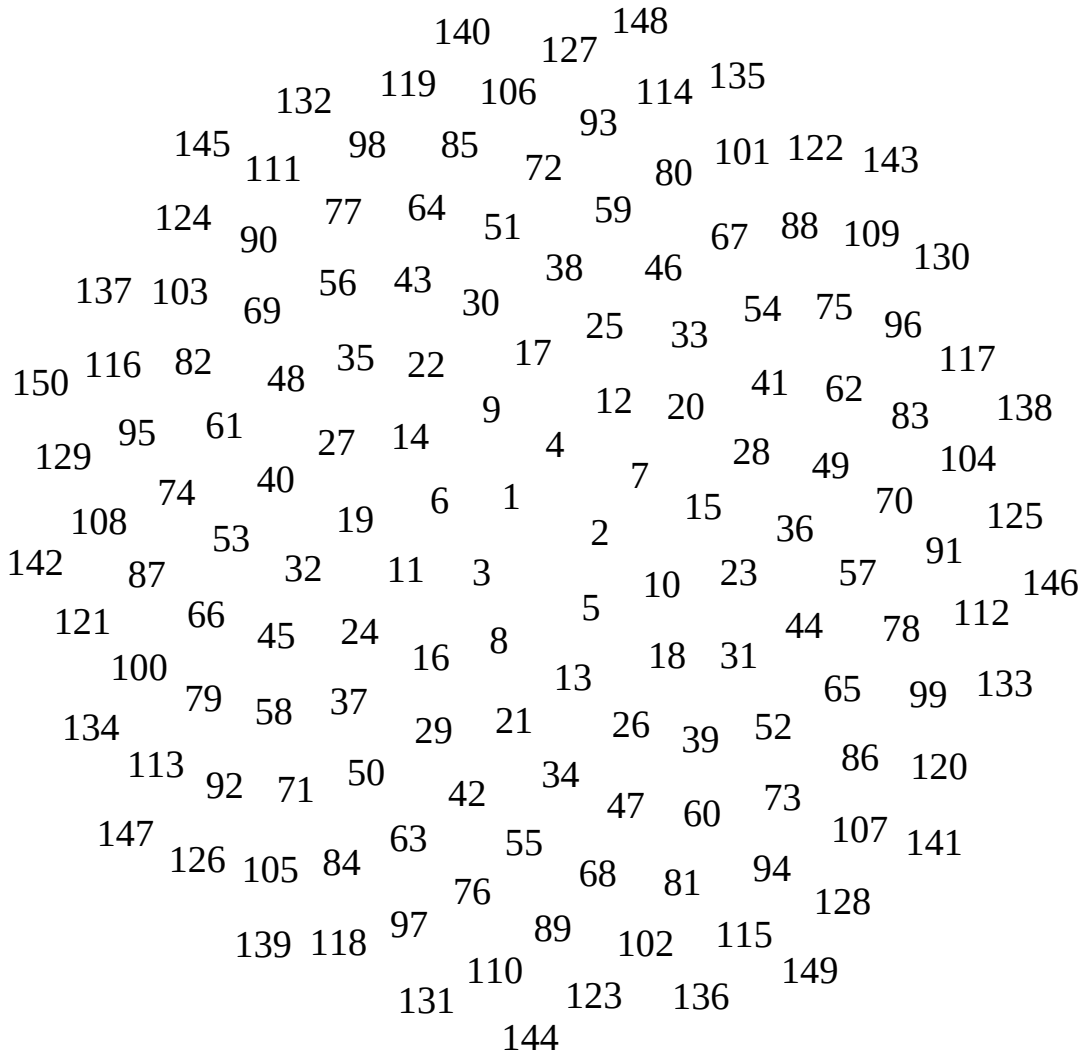


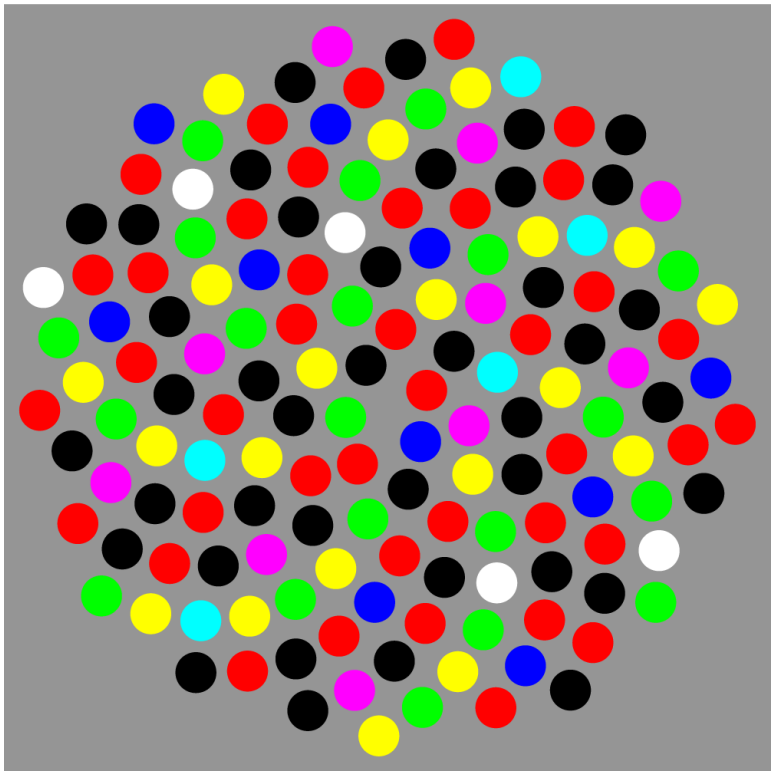
The basic pattern is this spiral of points, where the nth point is put down at radius $\sqrt{n}$ and angle $2\pi\phi n$, where $\phi = \frac{\sqrt{5}-1}{2}$ is the golden ratio.



Outer ring colouring:

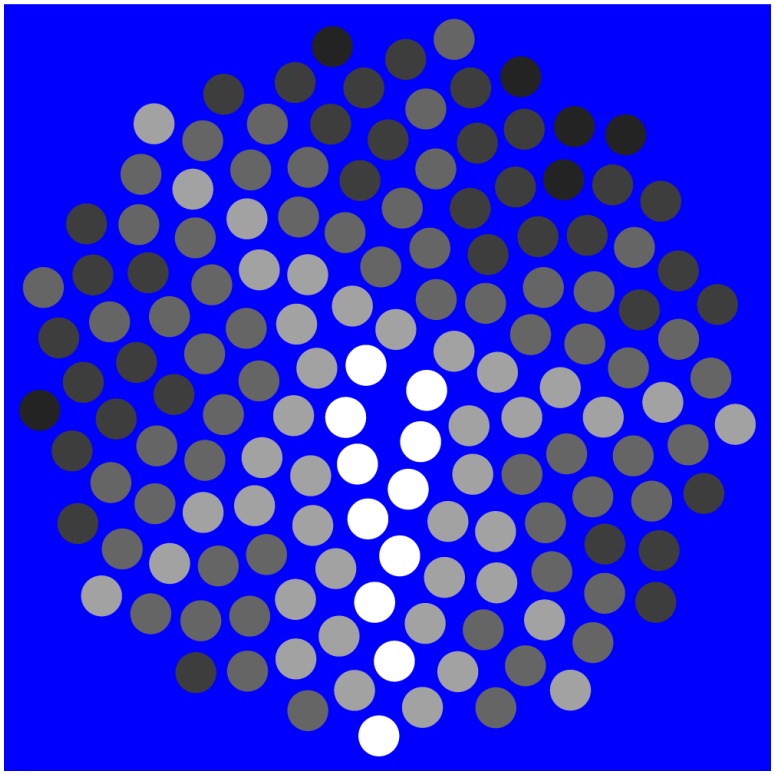
For the nth node, the colour contains:

$$\begin{aligned} \text{red if} \quad & n \cong 0 \mod 2 \\ \text{green if} \quad & n \cong 0 \mod 3 \\ \text{blue if} \quad & n \cong 0 \mod 5 \end{aligned}$$

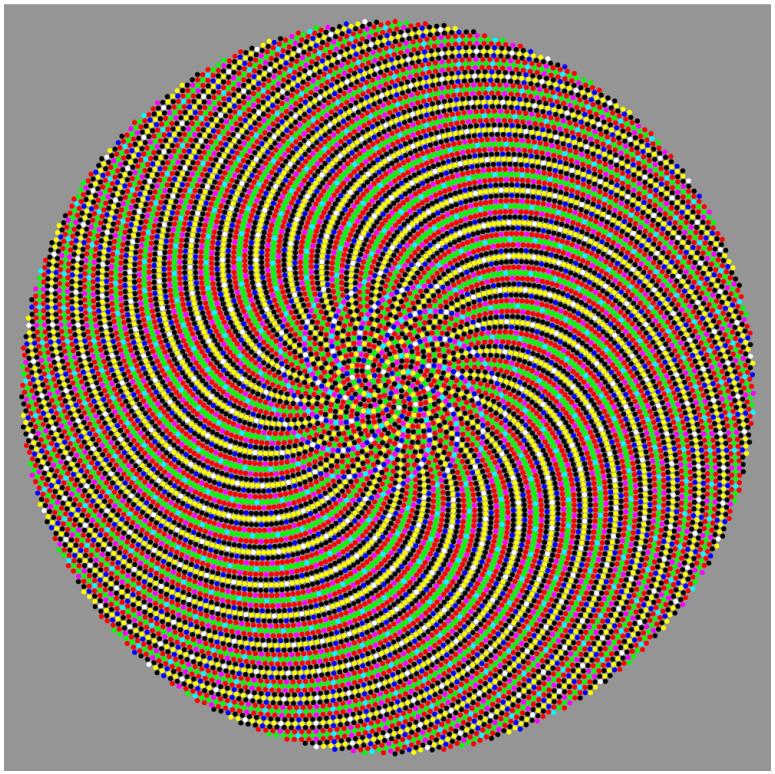


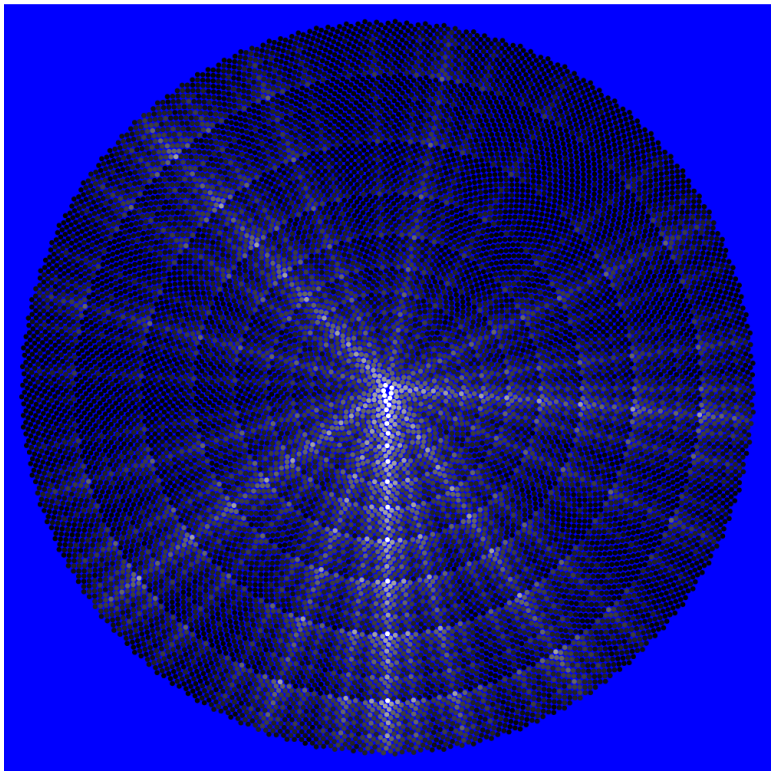
Background colouring:

The shade of grey is based on the "Fibonacci metric", which assigns to n the minimal number of Fibonacci numbers needed to sum to n.



These patterns continue outwards in interesting ways, here with $15,000$ nodes:





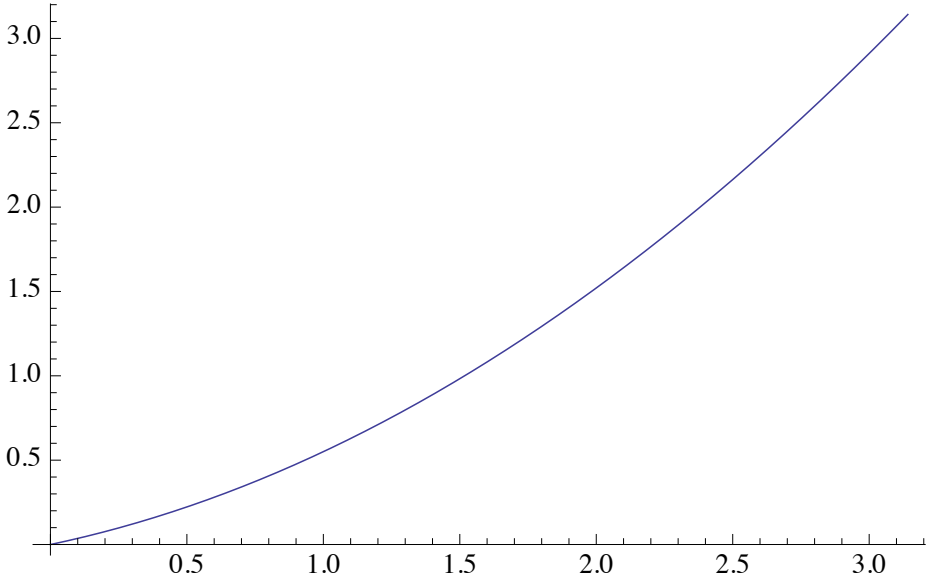
The pinecone shape

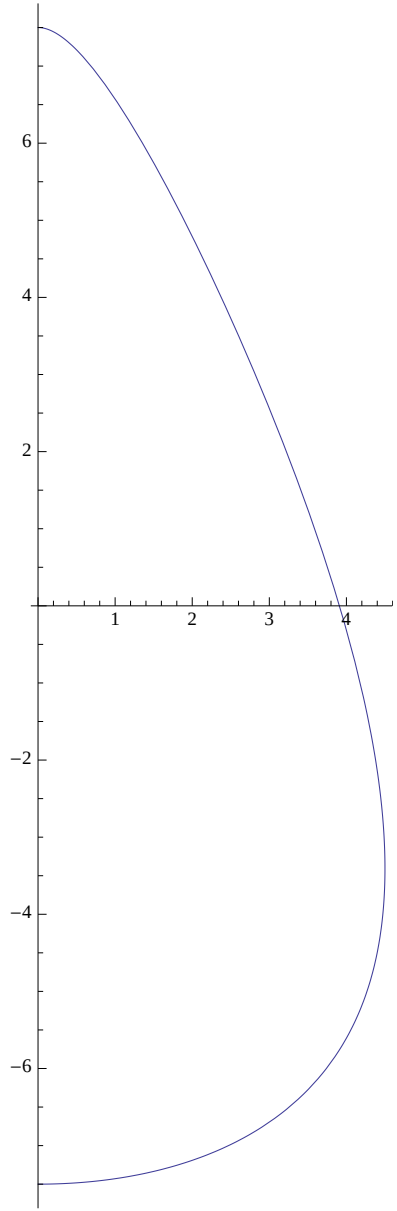
The shape of the pinecone, obtained after lots of tweaking and modifying, is defined as follows:

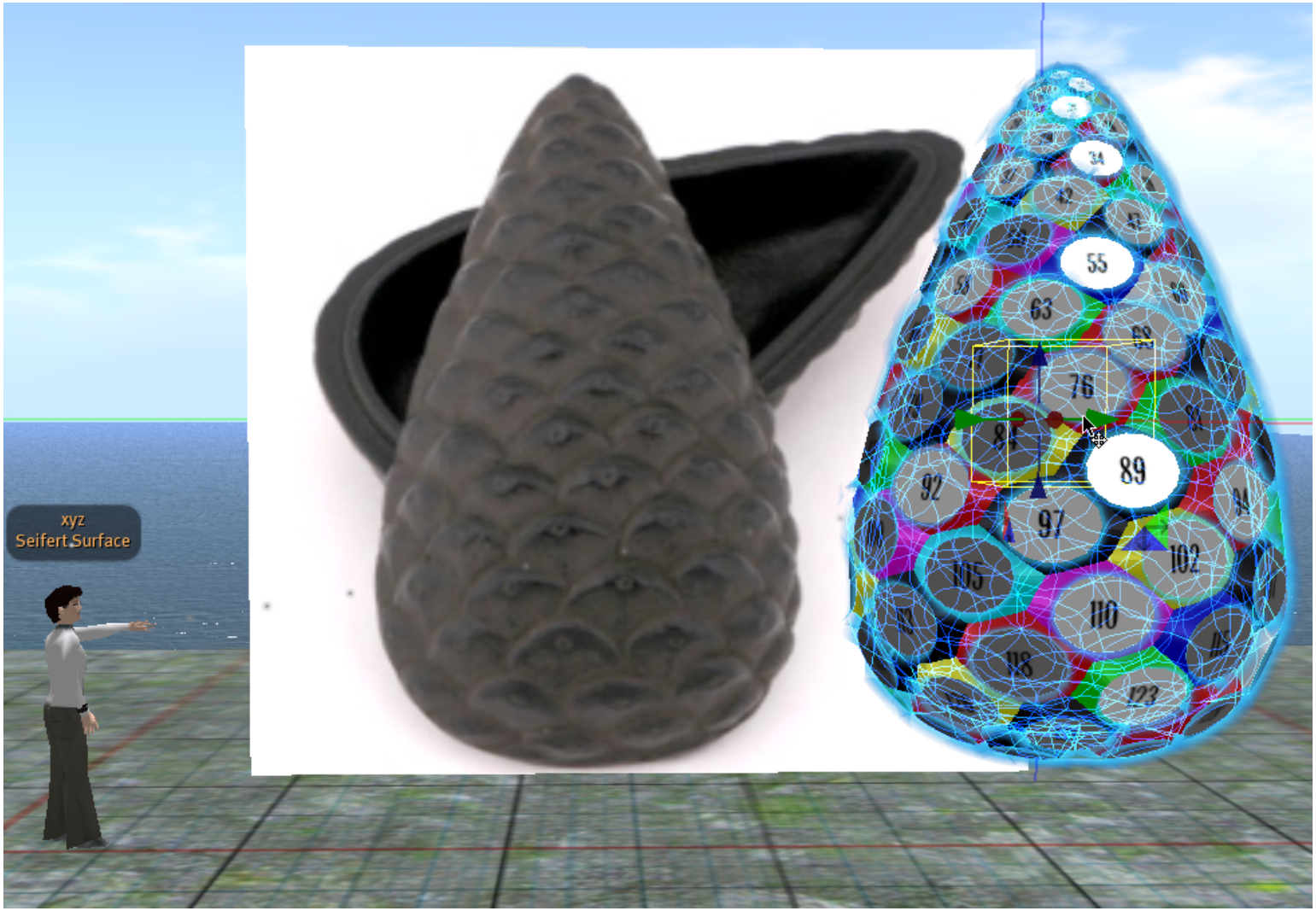
$$g(u) = 0.21u^2 + (1 - 0.21\pi)u$$

$$x(\theta) = 4.5\sin(g(\theta))$$

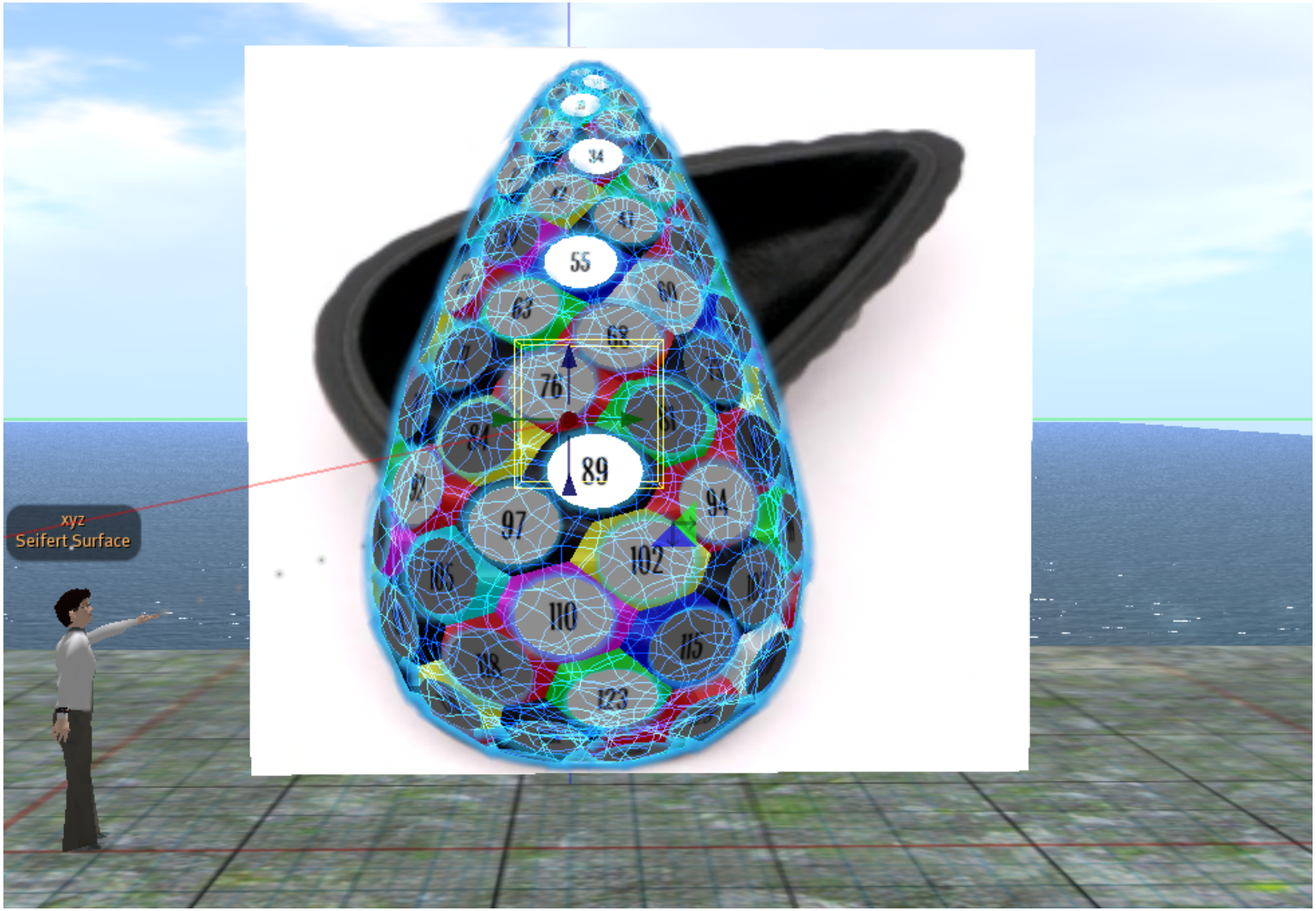
$$y(\theta) = 7.5\sin(\theta)$$







Using that curve we wrap the nodes around to form the pinecone. The shape was tweaked to match a photograph of an (idealised) "real-life" pinecone.



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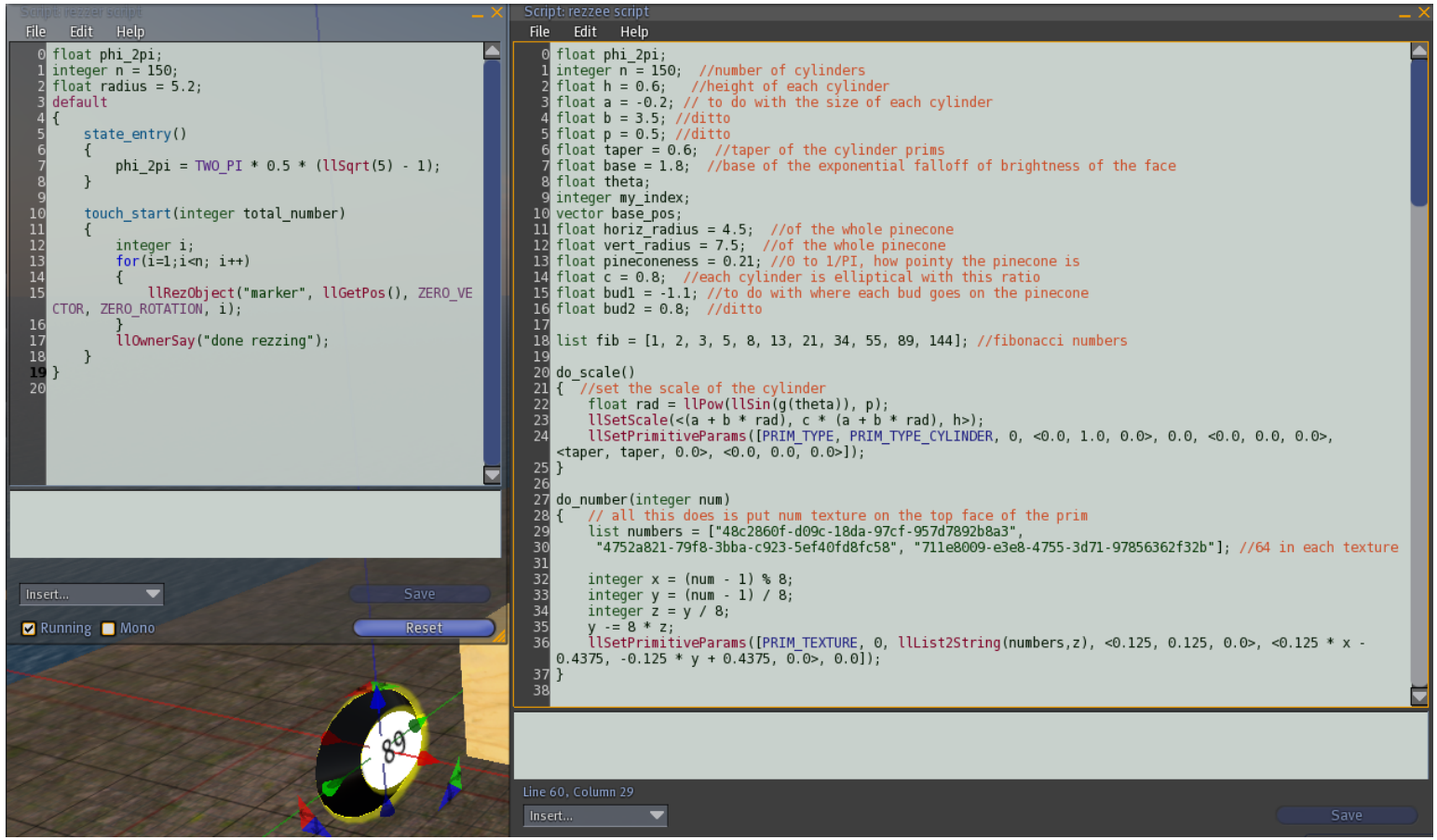
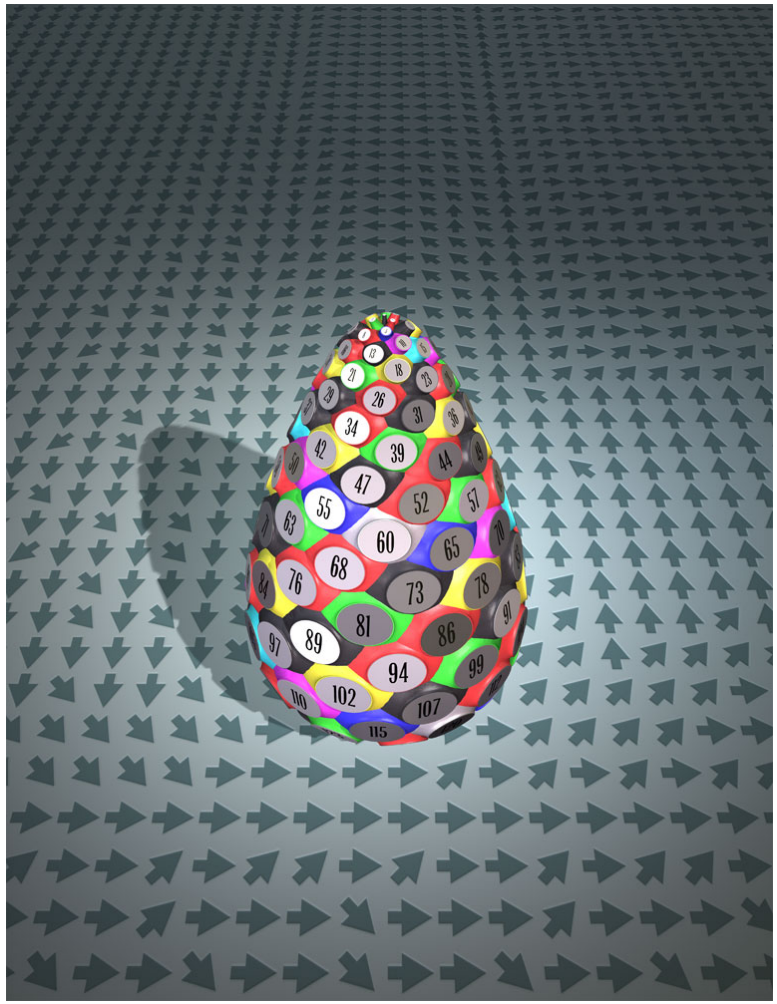
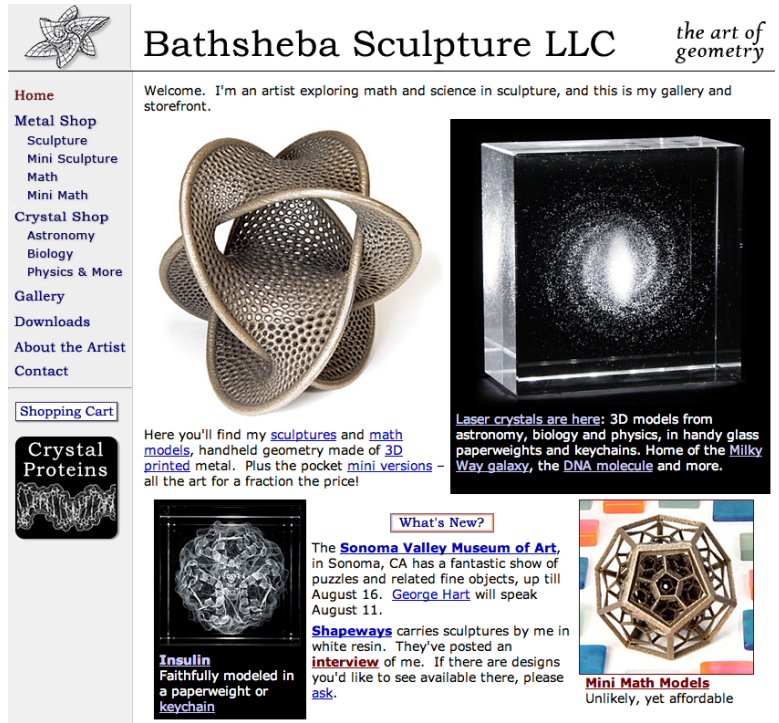
The scripting language in Second Life is event based, and syntactically similar to Java.



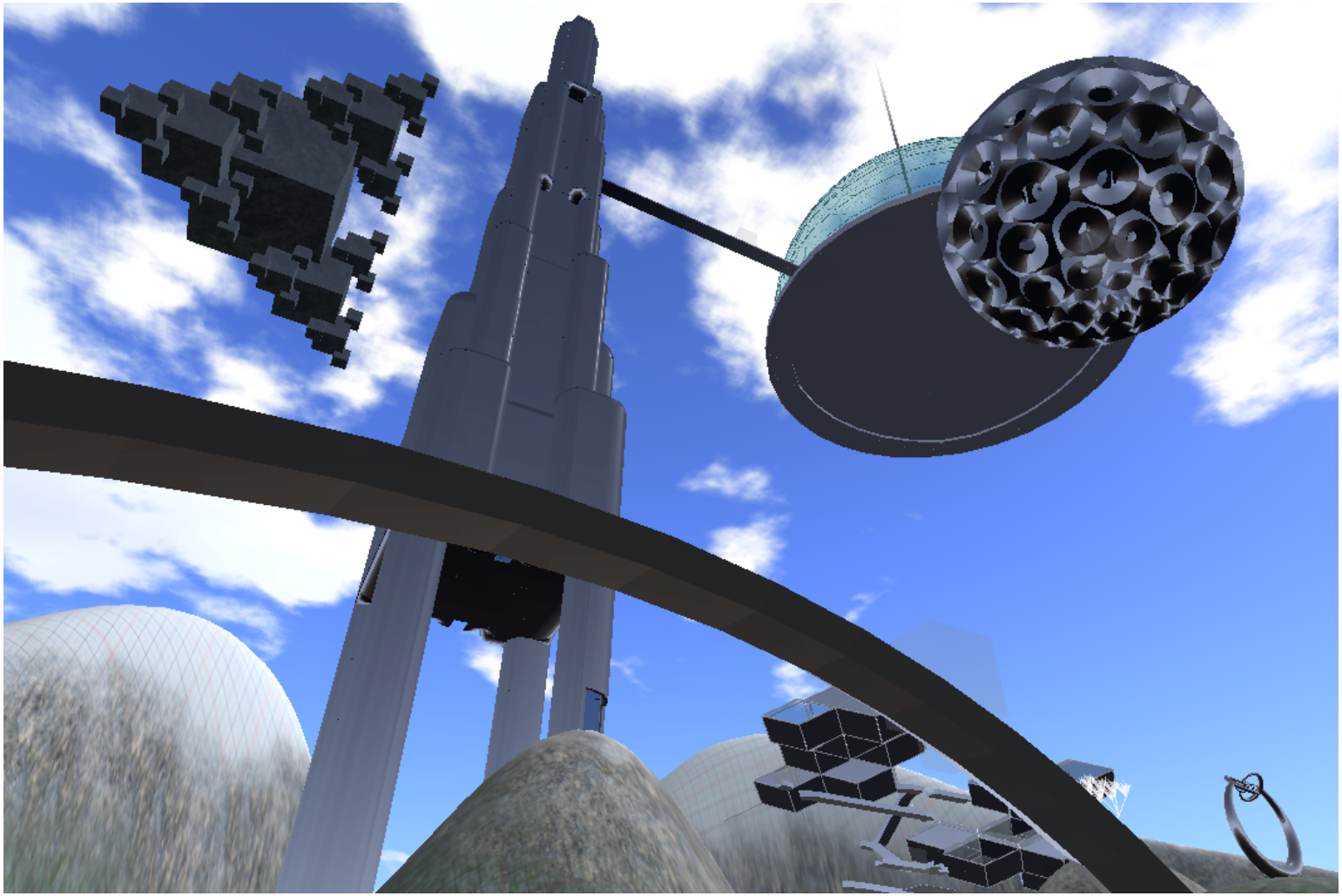


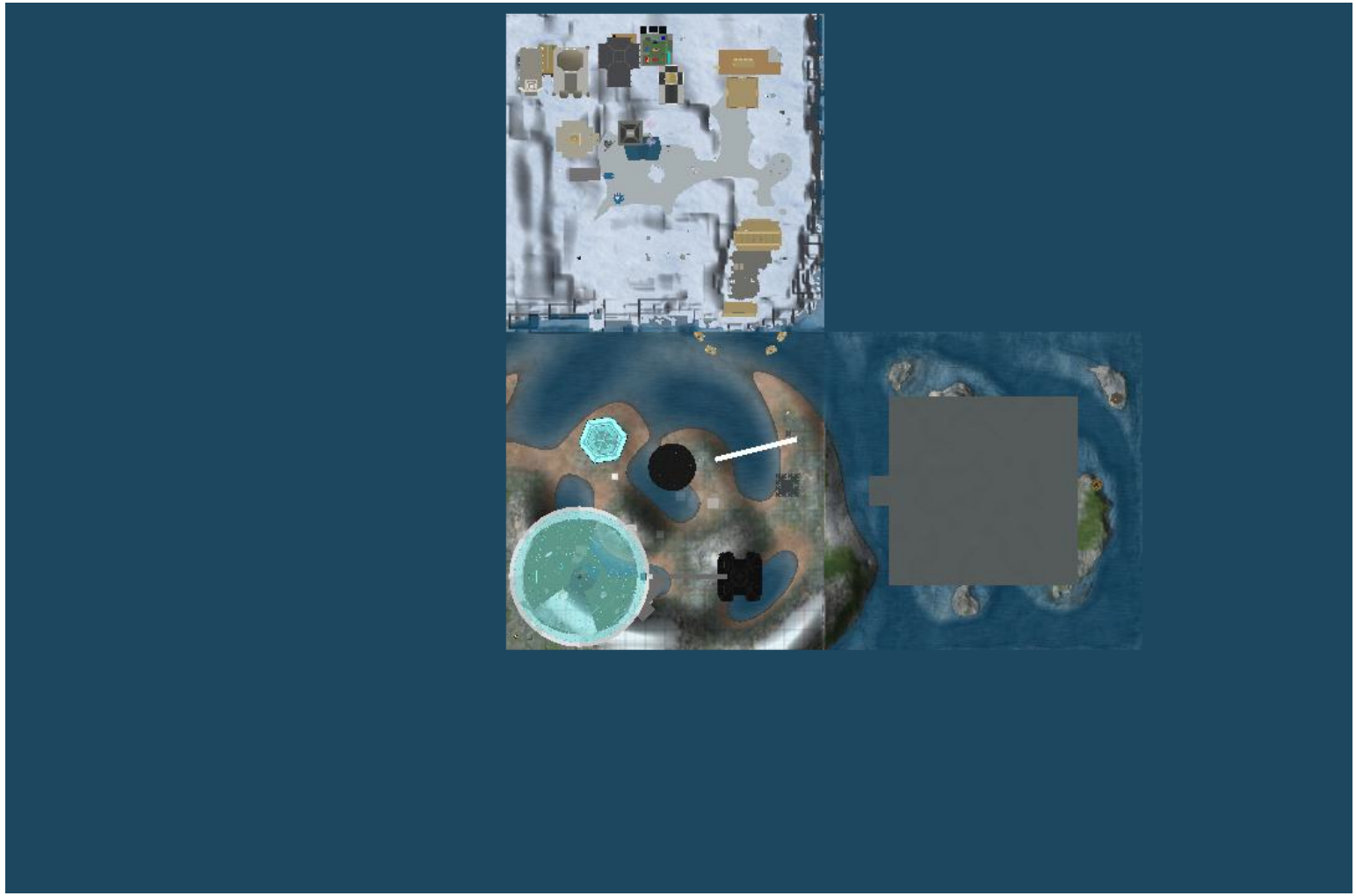
The final rendering was done by Bathsheba Grossman (www.bathsheba.com) using Rhinoceros 3d, a professional CAD program.



What is Second Life?

"Second Life is a free online virtual world imagined and created by its Residents."





Total land mass is around $1,800$ km^2 and approximately $750,000$ people log in each month.

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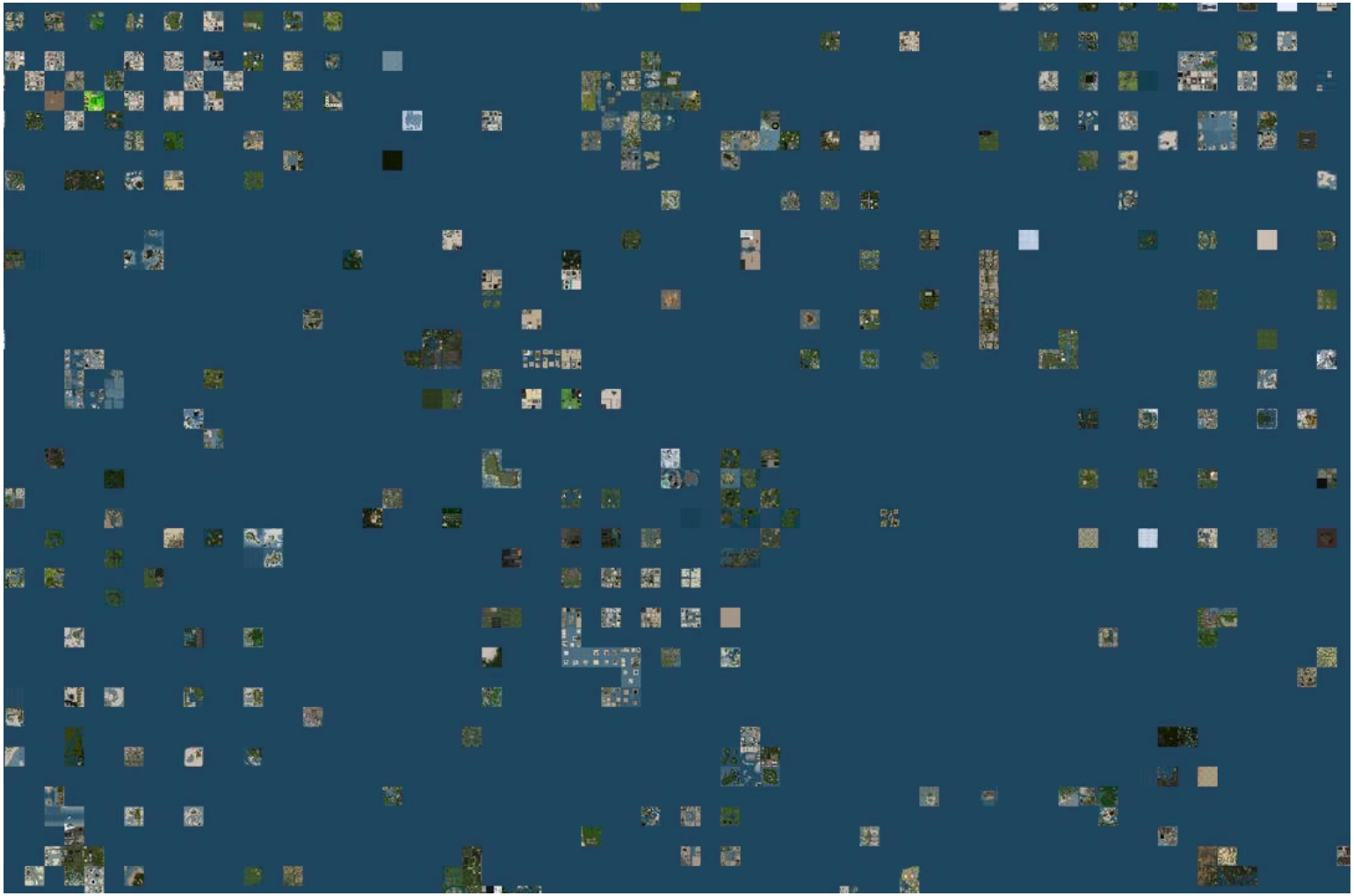

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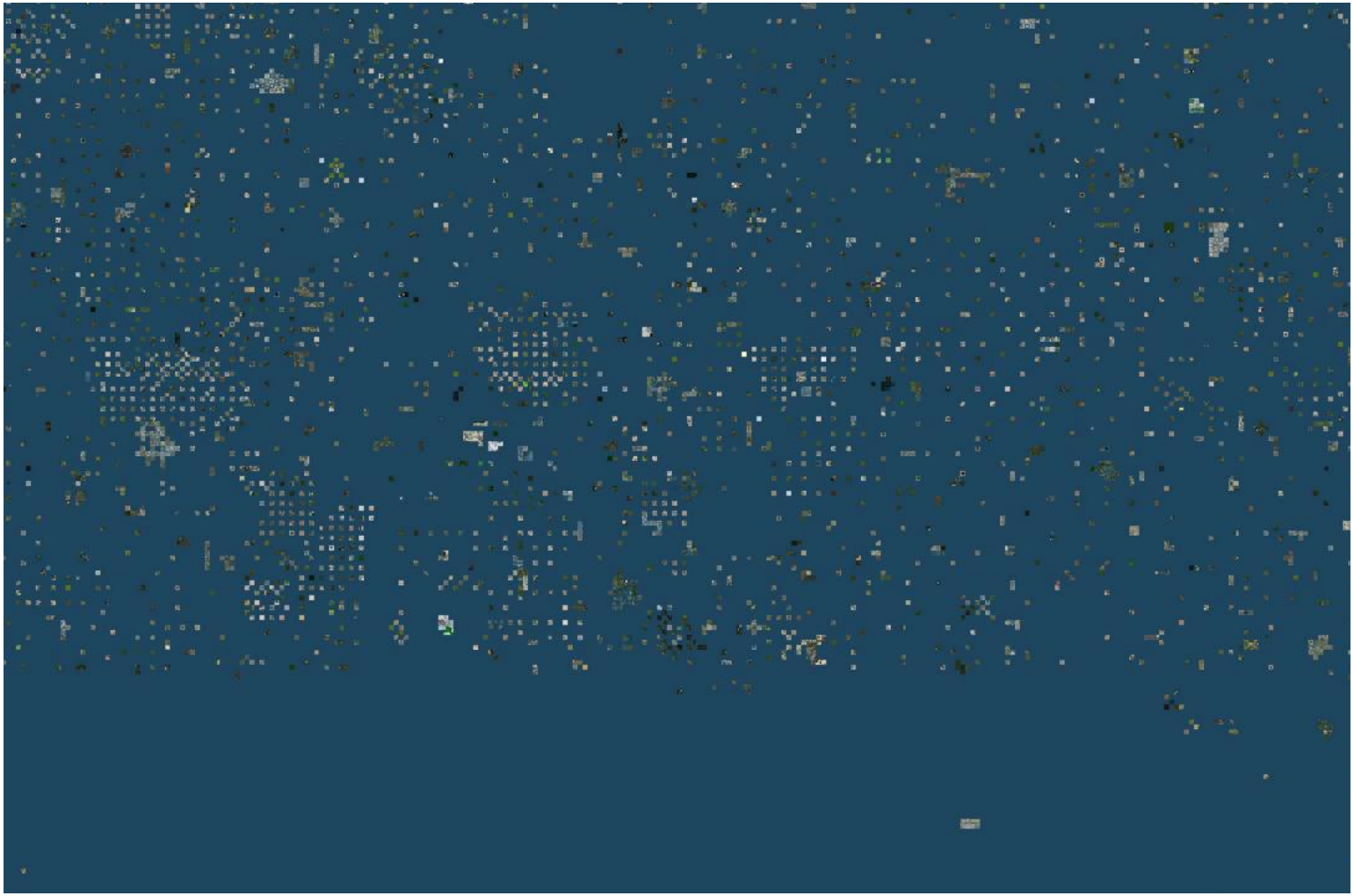

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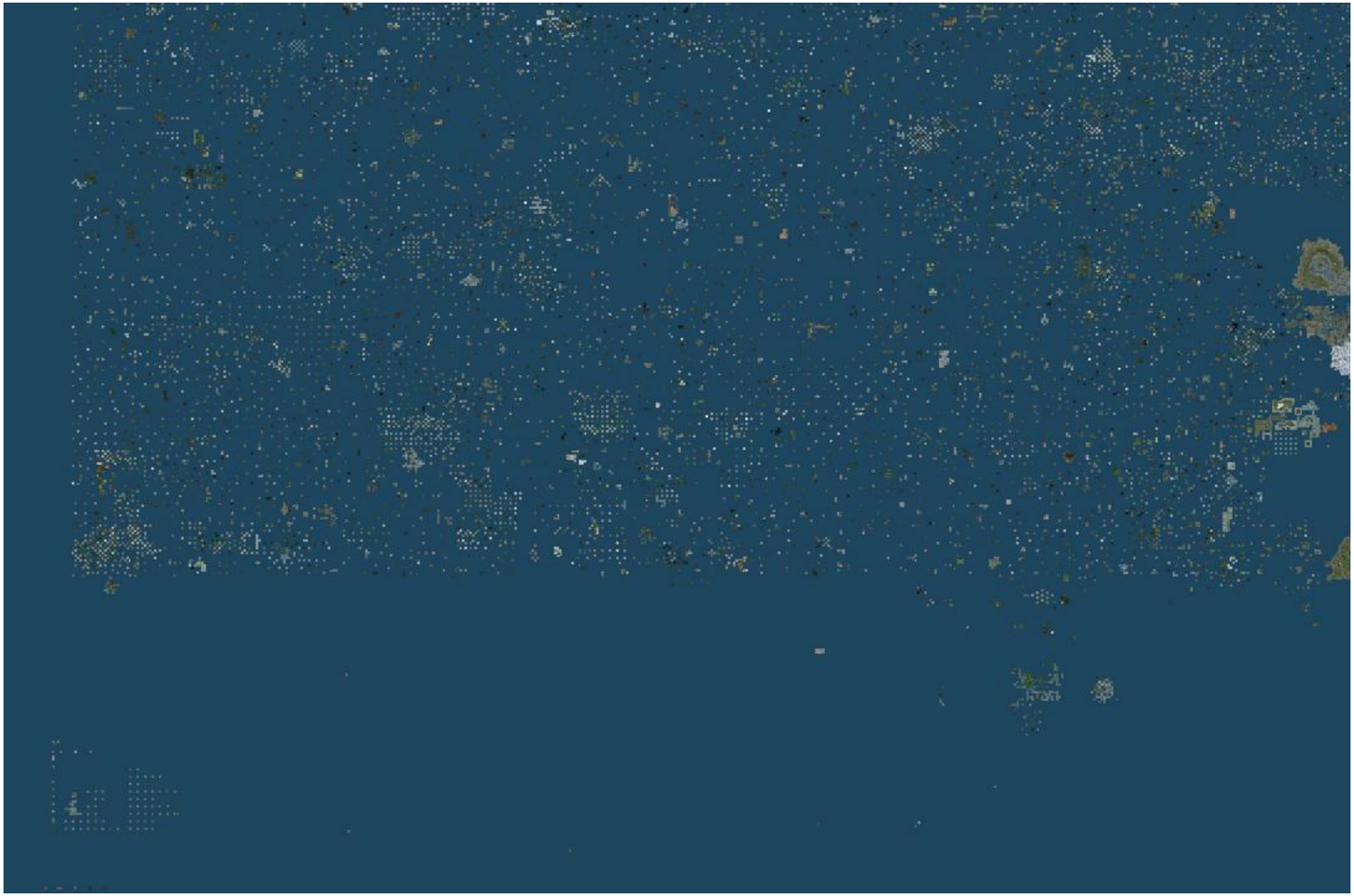

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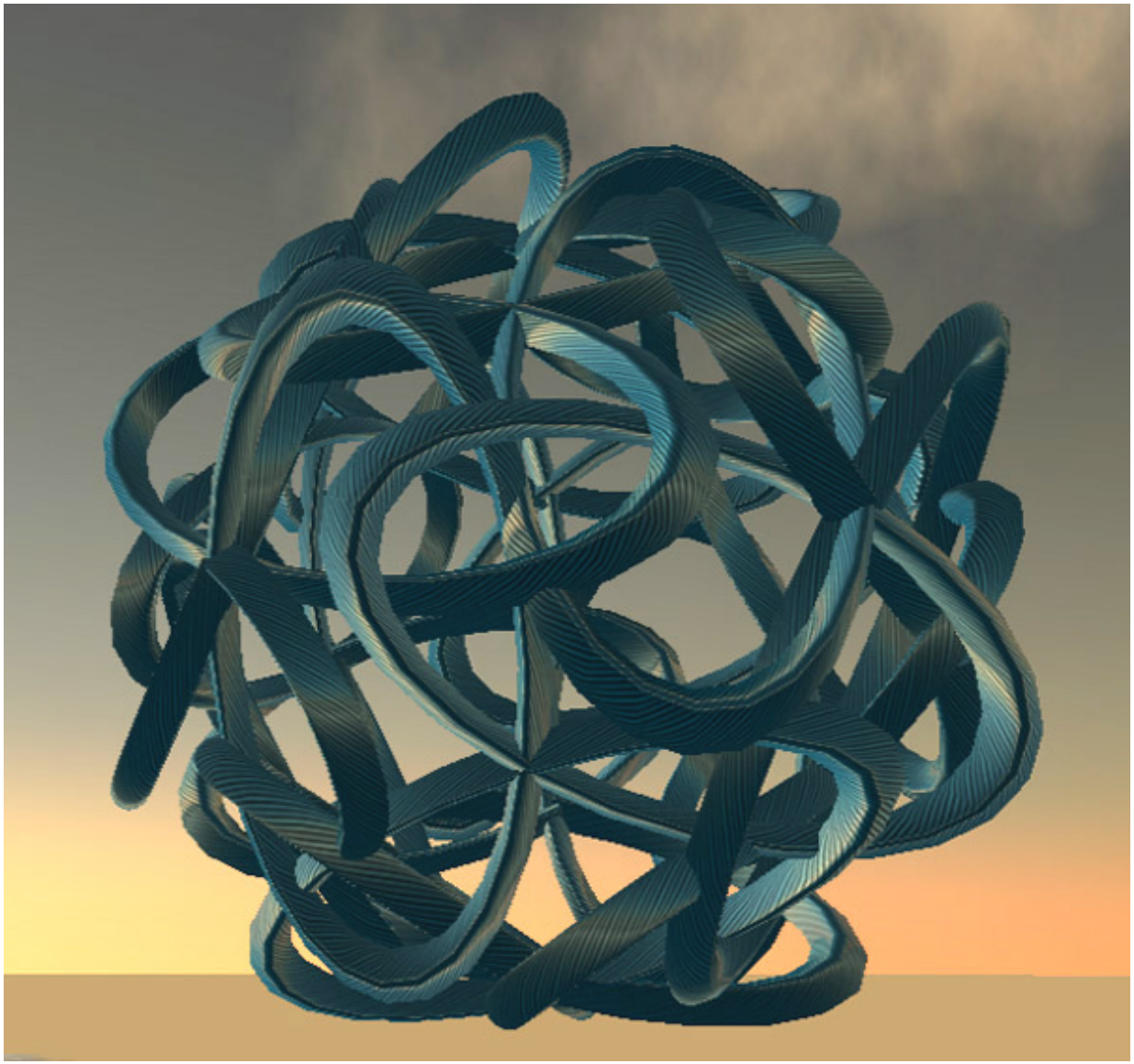
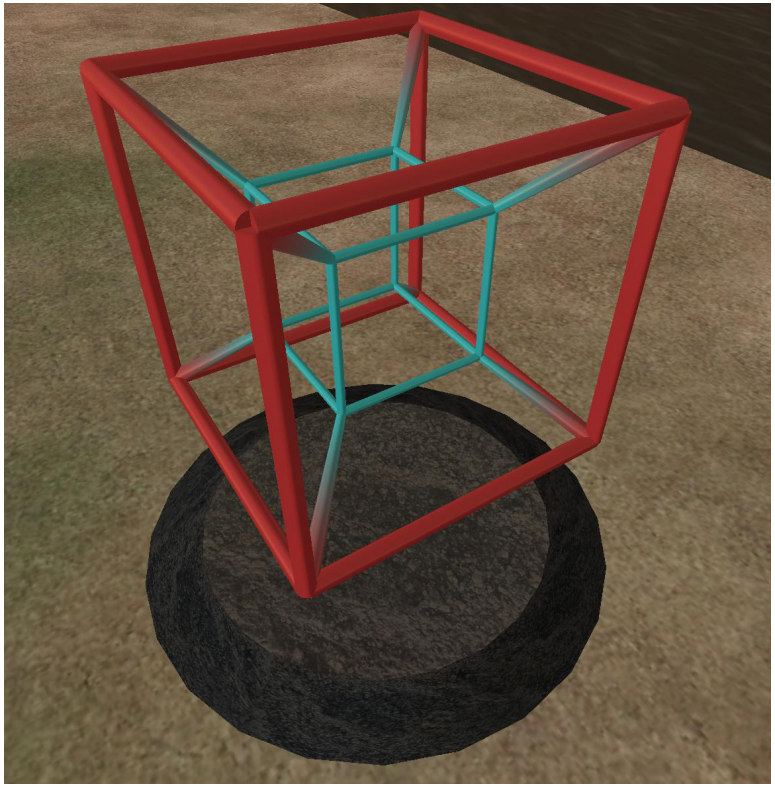
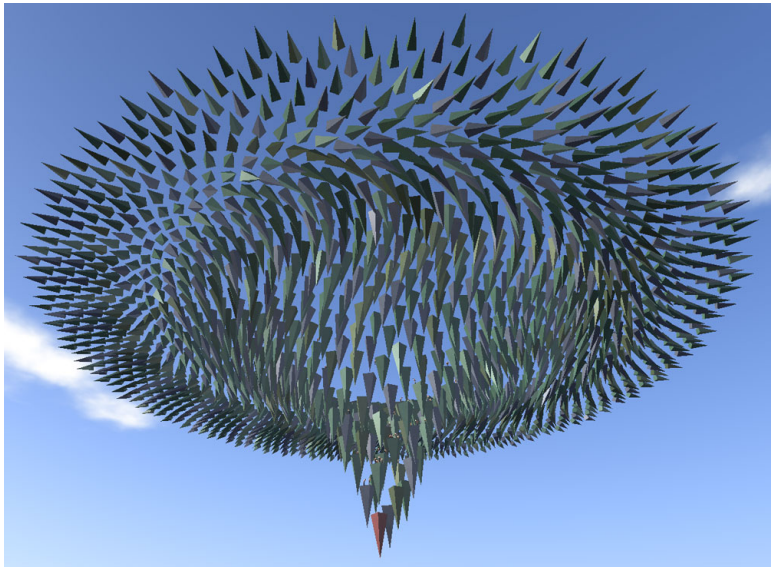
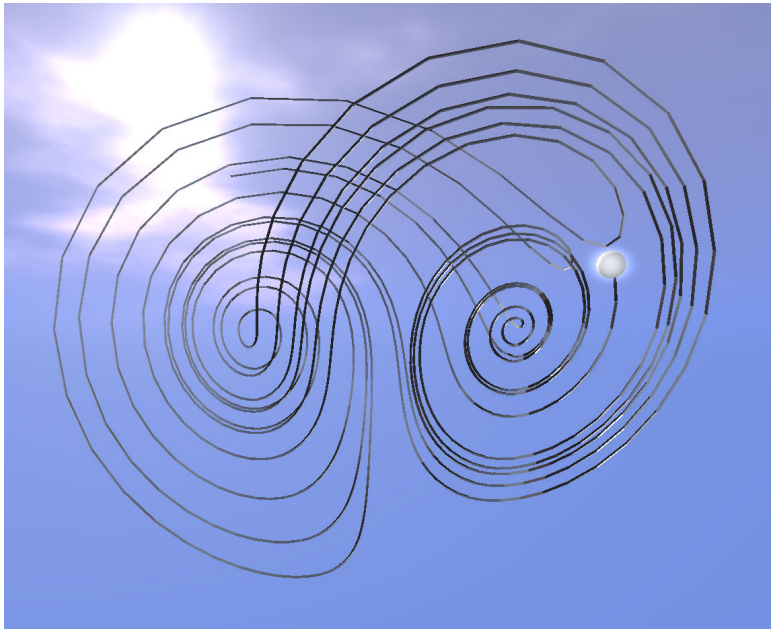
Mathematical Art in Second Life

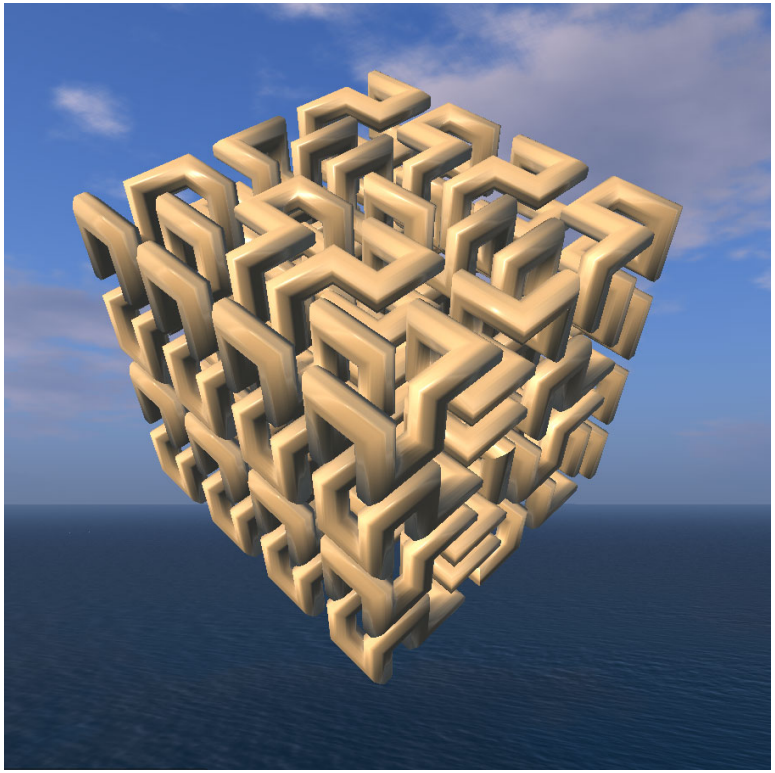


"RhombdO" by Bathsheba Grossman.

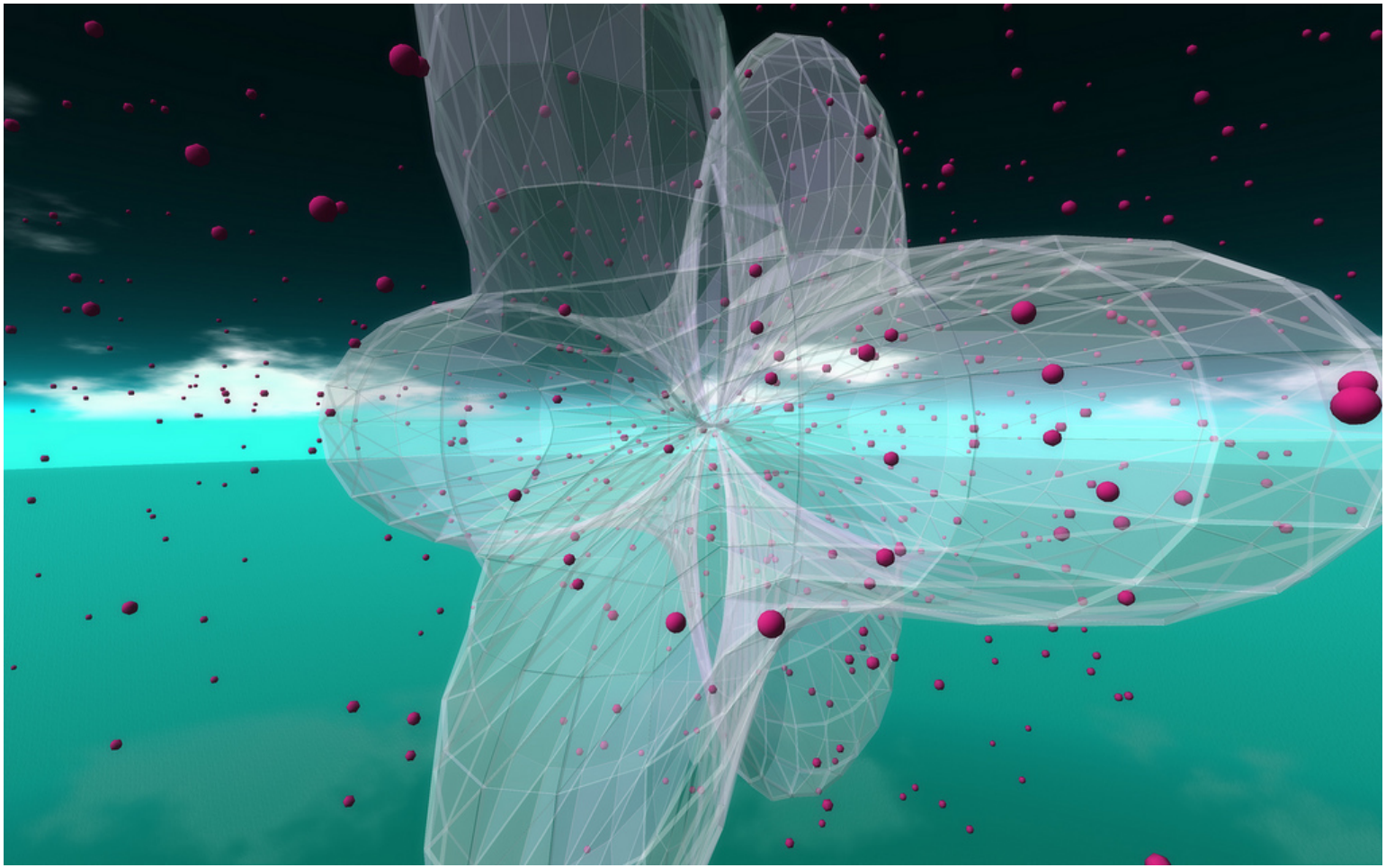




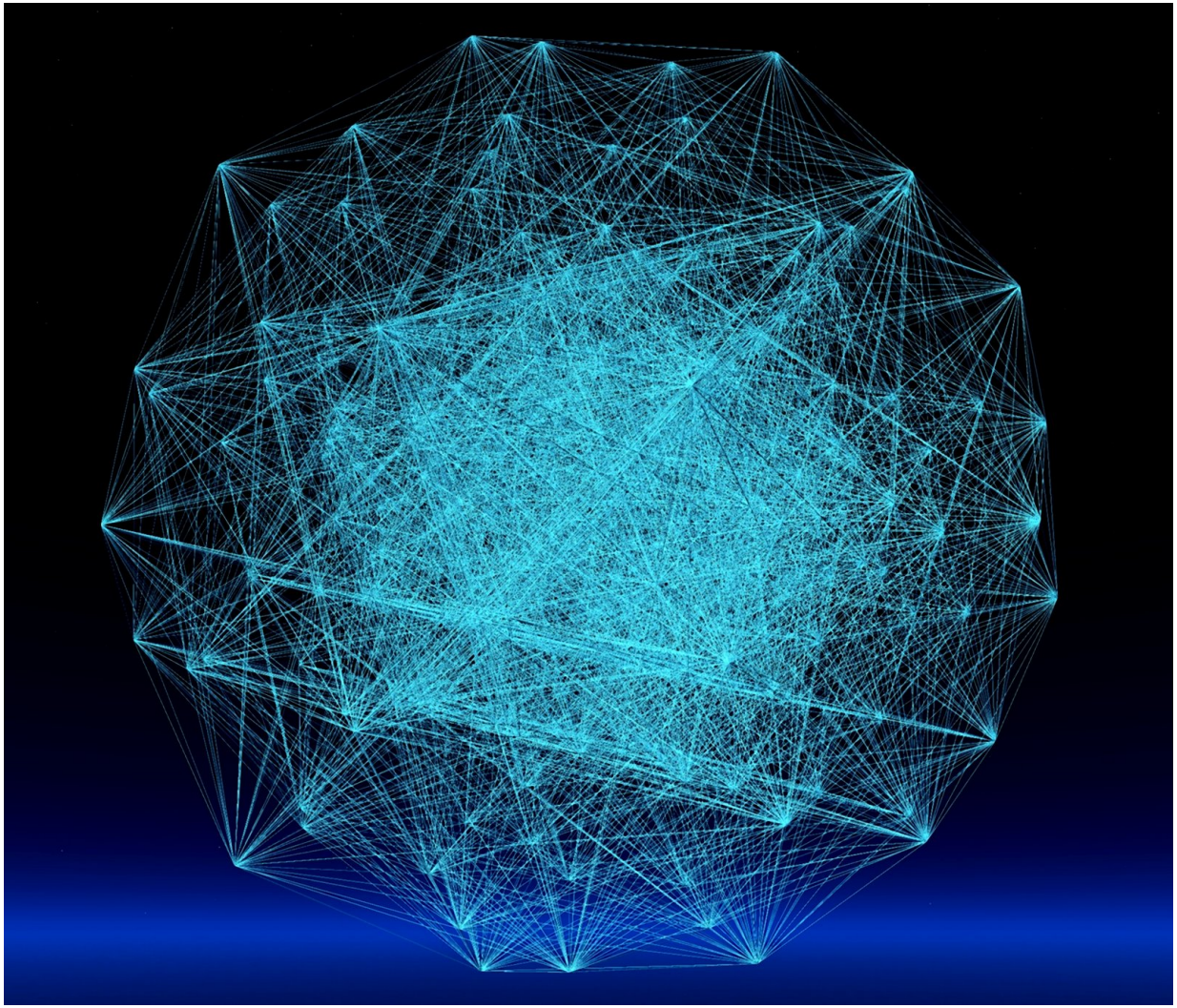




Various sculptures by me.

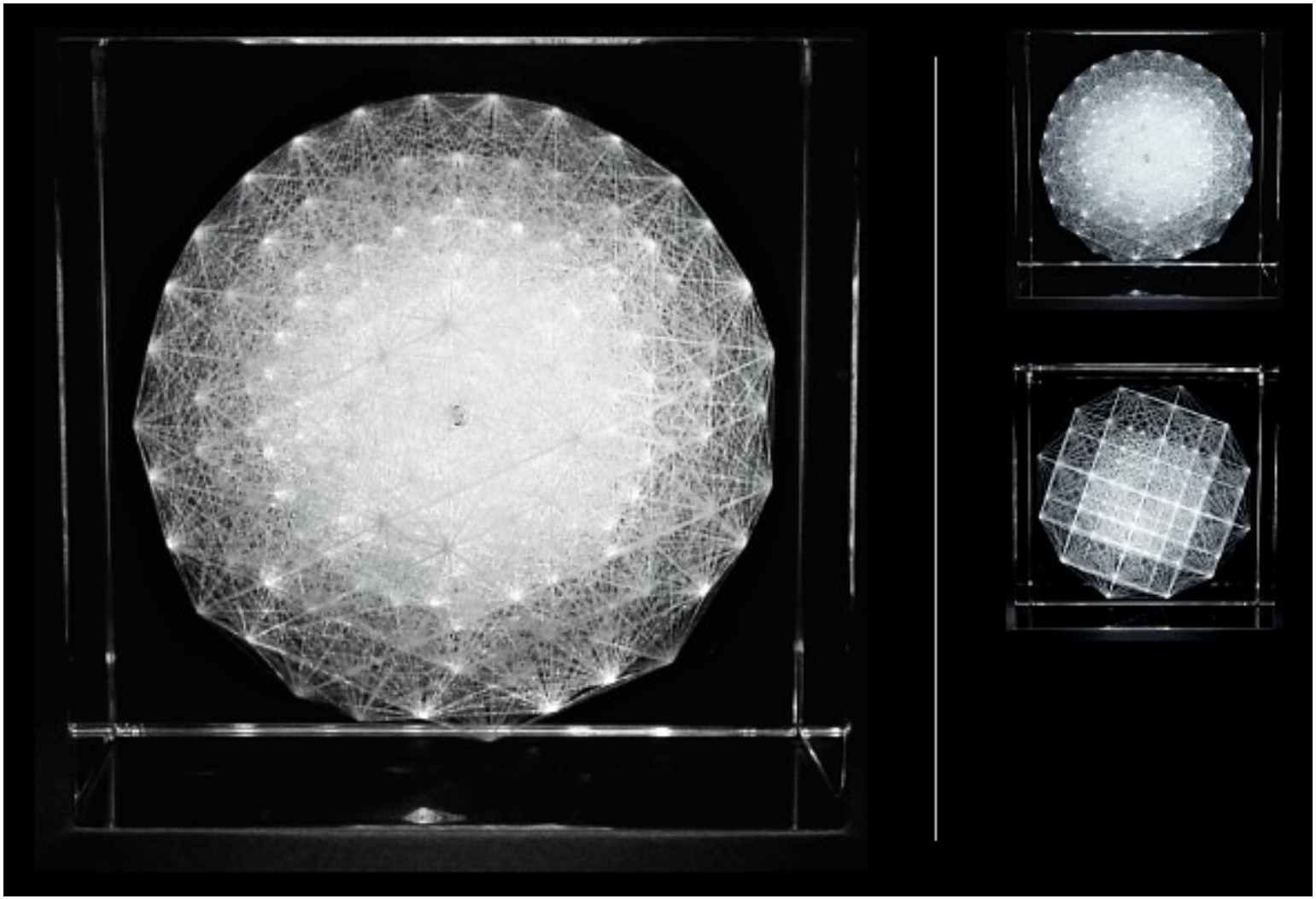


"Wire Flower" by Suzanne Graves (SL name)



A projection into 3-space of the Gosset 4_{21} polytope, which is itself a representation of the exceptional Lie group $E8$. By Wizard Gynoid, Desdemona Enfield and Nand Nerd (SL names).

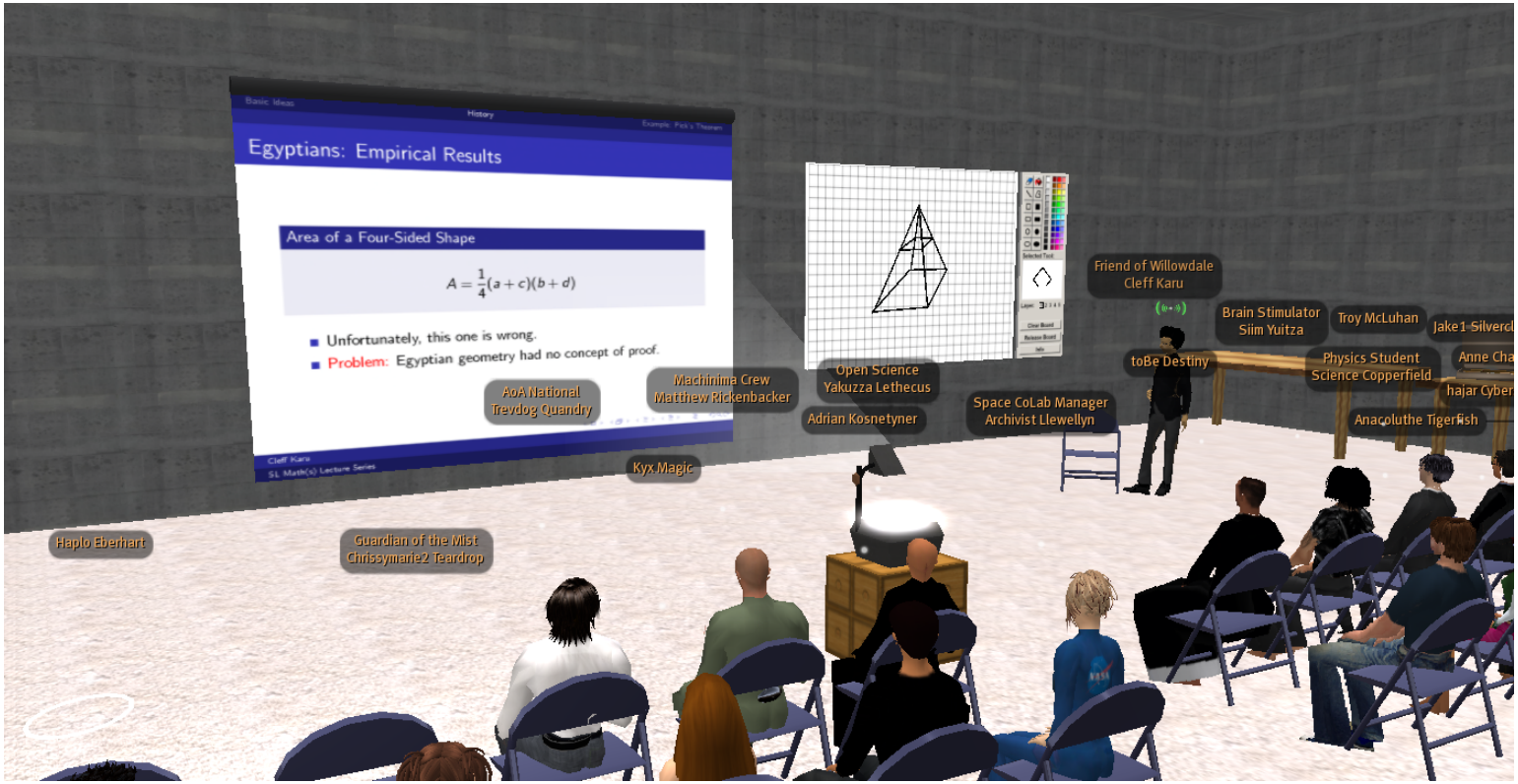
Wizard was advised by physicist Garrett Lisi (Garrett Netizen in SL).



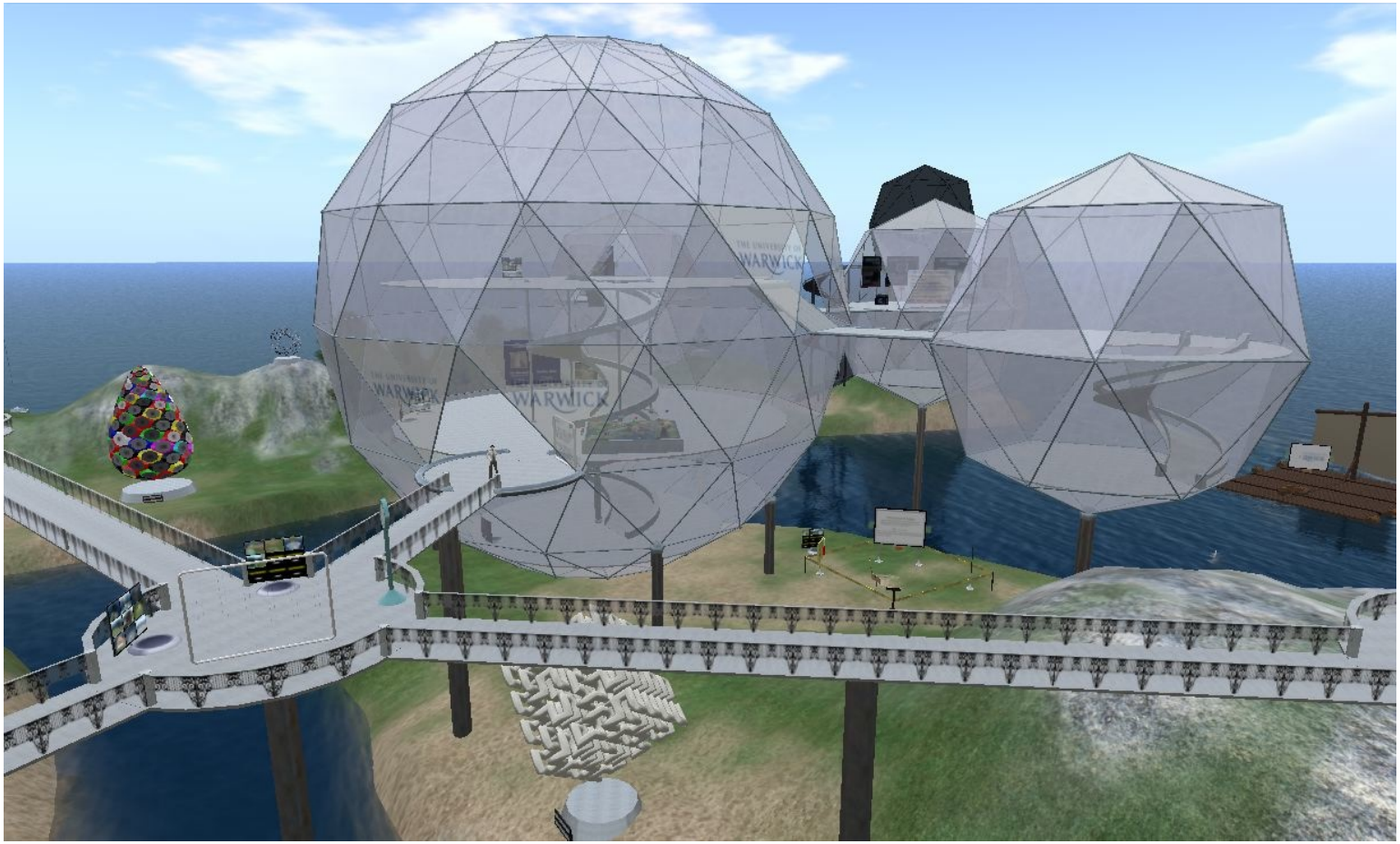
The model has since been brought to the real world by Bathsheba Grossman.

Math Education in Second Life

People also go to lectures in Second Life:



A lecture by Cleff Karu (SL name) on the history of mathematics.

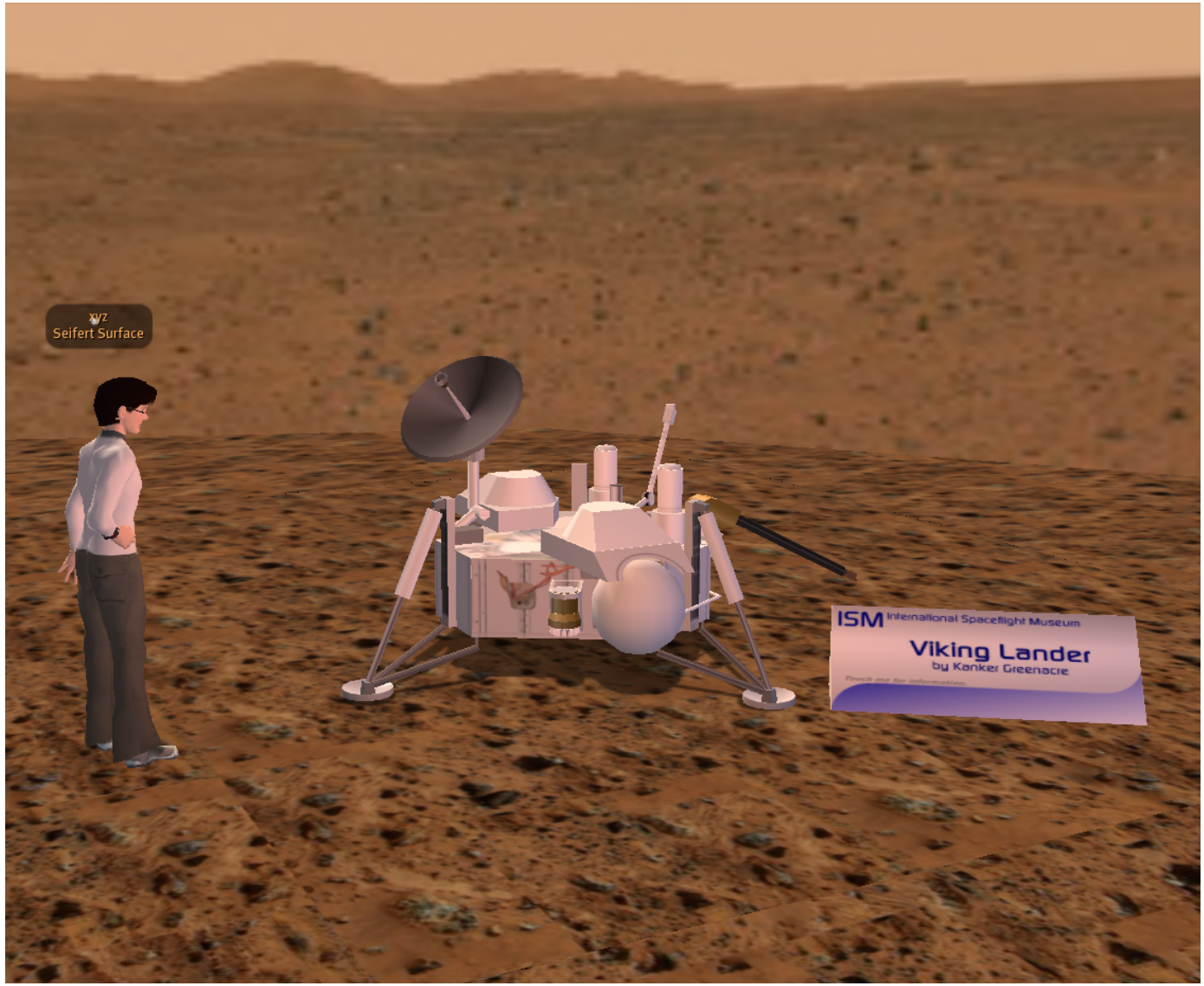


Warwick University mathematics department has a presence in Second Life, as do hundreds of universities and colleges worldwide.

"Virtual Morocco was a cross-reality service-learning project where Johnson & Wales University students worked with the Ministry of Tourism in Morocco to develop Casablanca island as a tourism promotion tool and a space for cross-cultural collaboration."

Developed by Hilary Mason, Mehdi Moutahir and students.

Most uses in the sciences are in museum style exhibits.

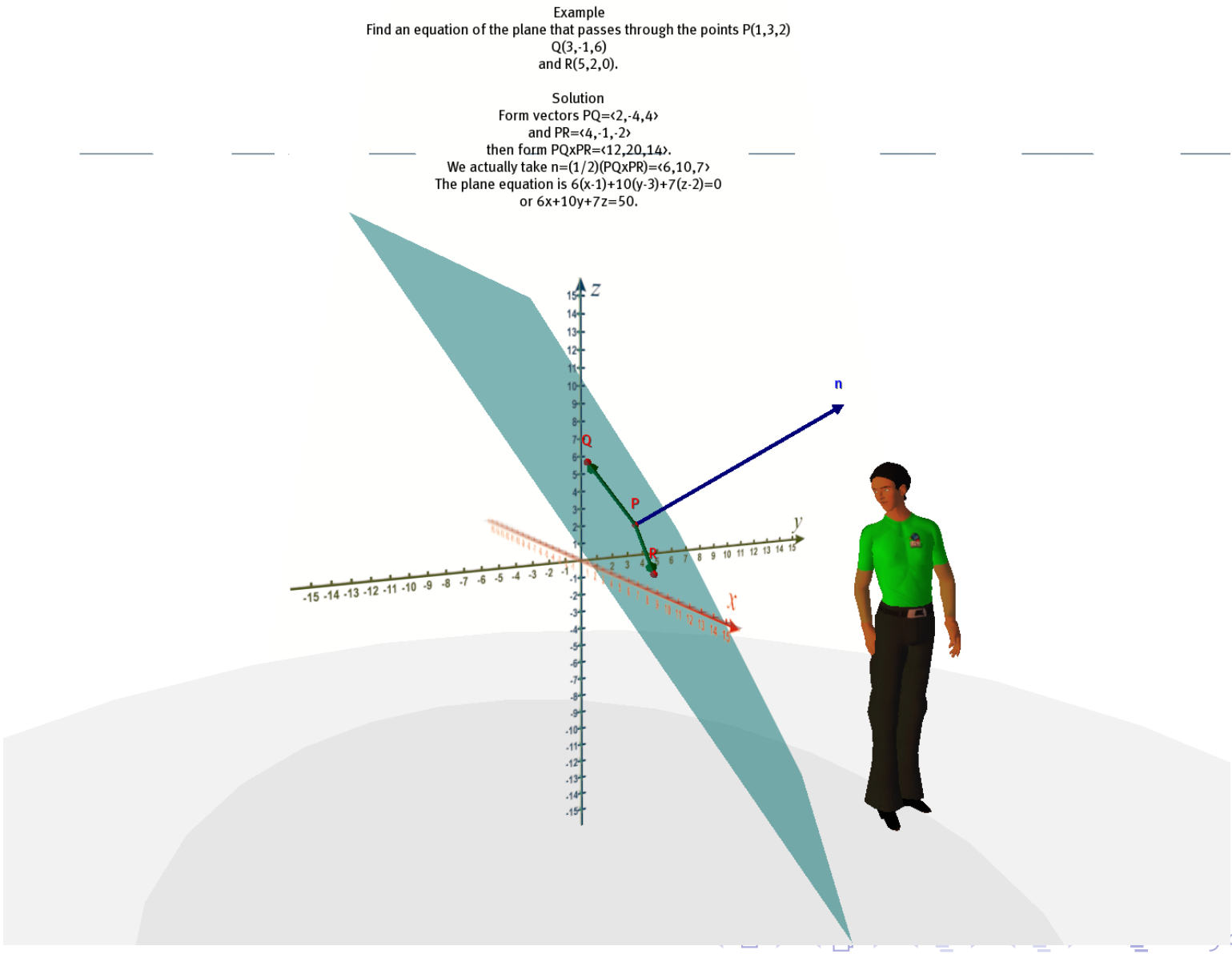


Viking Lander model, by Kanker Greenacre (SL Name) at the International Spaceflight Museum.

A working Turing machine, developed by Kenneth Schweller at Buena Vista University.

Mathematical exhibits at the New Media Consortium, by me.

Przemyslaw Bogacki, a.k.a. Reaso Ning (SL name) has experimented with using Second Life to teach linear algebra at Old Dominion University.



Pros and Cons to using Second Life in education

Pros:

- Free to explore and use.
- Relatively inexpensive to have a permanent presence.
- Location is irrelevant (good for distance learning etc.).
- Good voice and text communication.
- Very active existing education community.
- 3D virtual classroom interaction works better than other distance learning methods.
- Virtual worlds are *built* on mathematics. Geometric knowledge translates directly into being able to make something.

Cons:

- Technology is still in development: some reliability issues.
- Requires a good graphics card and broadband internet connection.
- No writing on a blackboard!