Adding Up Gear Spheres

Math, Gears and 3D Printing Come Together to Make Art

Alex Cannella, News Editor

Paul Nylander is something between an entrepreneur and a Renaissance man. He has degrees in engineering and physics, but he's also a creative artist who's put together sketches and 3D renderings alike. His website, *bugman123.com*, features everything from an in-depth explanation of a Tesla coil to 3D renderings of physics equations to an extensive library of fractal-based artwork. At first glance, one might find Nylander's many pursuits to be somewhat scattershot, but at their core, his works are tied together by his love for all things mathematical.

As you've probably already guessed, one of Nylander's myriad interests is gears. Specifically, he makes gear spheres. They're exactly what they sound like: art pieces where gears are interlocked together so that they form a sphere. It is, however, a recent interest as far as Nylander's portfolio goes. He's been making gear art for four years now after a friend introduced him to the idea. As with many things, Nylander took it and ran with it.

"My friend was an engineer," Nylander said, "and he had a book on gears. And he showed me all these weird kind of gears in that book. And I'd already seen gear spheres and stuff online before, but after looking at my friend's book, I was like, 'This is kind of my thing.' I love math, I love engineering, and this is really something I should get into."

Nylander's designed spheres with 32, 92, 182 and 242 gears, and they all work. The crown jewel of the collection, however, is the "Bucky Brain Gear/Sphere Gear Combo" (pictured right). The piece combines Nylander's 32-gear sphere with what he's dubbed the Bucky Brain Gear, which, as Nylander describes on his website, is "a set of 60 interlocking double bevel gears arranged to rotate freely around the edges of a truncated icosahedron (Buckminsterfullerene), with the gear planes forming the edges of a rhombic triacontahedron."

With the Bucky Brain Gear, Nylander's love for math and science shines through, particularly in the piece's name, which is at once both descriptive and referential. Icosahedrons are 20-sided polyhedrons, but when you truncate one, or cut off its vertices, it becomes 32-sided. This shape, the same one Nylander used as a skeleton for his gear art, is also the same as a particular carbon molecule, Buckminsterfullerene, or as some call it for short, a buckyball, hence the Bucky Brain Gear's name.

"If you truncate an icosahedron, it's basically like a soccer ball," Nylander said. "And you can push that further and you can keep tessellating more and more hexagons and pentagons."

The shape is also the basis of the geodesic dome (made famous by Buckminster Fuller...see the rabbit hole of references here?), and thus a natural frame for many of Nylander's more traditional gear spheres. With both Nylander's normal and Bucky Brain spheres sharing the same framework, it may have been inevitable that they got mashed together into what you see here: a cornucopia of gears so tightly packed together that they can't even be made by hand. Because of the way the Bucky Brain Gear half of the piece interlocks with the rest, the Gear Combo can only be made via 3D Printing.

Surprisingly, somewhere in all those gears, Nylander also managed to fit a lightbulb. The Gear Combo also works as a lamp with different settings that could either illuminate your desk or just provide a cool carved pumpkin-esque look.

"I think the concept of a geared sphere is something that could actually be a real moneymaker in a variety of ways," Nylander said. "If it has utility and it has a use like a lamp, and it happens to be cool because it has moving gears on it, then I think it's gonna be much more interesting to a larger audience."

Moneymaker or not, the Gear Combo is still a work in progress for Nylander, though he did show off a prototype at the 2014 3D Printer World Expo. While it's clear that he intends to sell them eventually, it'll be a while before you can pick up a lamp of your own. While you're waiting, however, there's still plenty of math art to be dazzled by.

For more information:
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