

Animation of Cubic Truncation

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For my project I have decided to use the ray-tracing computer program POV-Ray to illustrate the truncation process that changes a cube into an octahedron. This process starts with a cube, and slices off a piece of all 8 corners of the cube. This leaves small triangles on every corner of the cube. As you slice further, the triangles enlarge and the previous faces of the cube become smaller. When the former faces of the cube become regular octagons, an Archimedean solid is created—the truncated cube. Slicing further creates a cub-octahedron. When the triangles begin to overlap and create regular hexagons, a truncated octahedron appears. Eventually, after slicing away a certain amount of the cube, the cube is transformed into an octahedron.

To demonstrate this with POV-Ray, I began with a cube and used two types of structures to begin chopping the cube. To cut off the pieces of the cube, I defined 8 planes which were given distance from the origin, which I placed at the center of the cube. As the animation process ran, the distance from these planes to the origin gradually decreased, cutting off larger and larger pieces of the cube. To replace the holes made by the planes, I had to define triangles to fit the holes. To do this I placed a triangle at each vertex of the cube, and as the planes moved toward the center of the cube, the triangles' coordinates increased evenly in the x , y , and z directions. Once the triangles began overlapping, the same planes used to cut the cube contained the excess parts of the triangles. So, at the beginning only the cube existed, and at the end the cube was gone and an imaginary solid created by the 8 triangles existed: the octahedron.