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# Parametric Natura Morta

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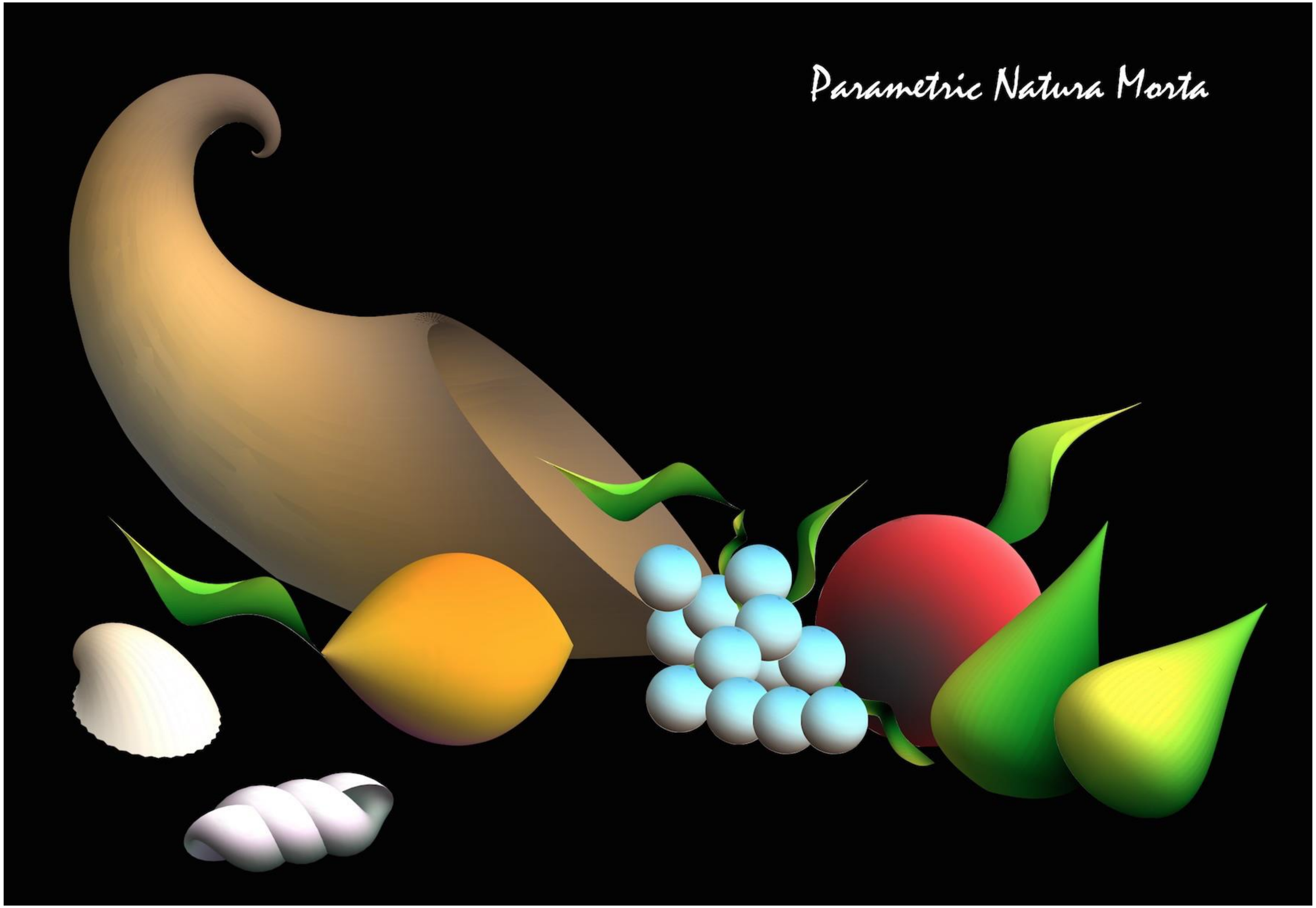
# Parametric Natura Morta

## Abstract
Parametric equations can also be used to draw fruits, shells, and a cornucopia of a mathematical still life. Simple mathematics allows the creation of a variety of shapes and visual artworks, and it can also constitute a pedagogical tool for students.

## Keywords
parametric equations, still life, visual arts, mathematics and the arts

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My mission is to investigate two-way relationships between mathematical concepts and arts: from mathematical beauty to arts, and from arts—and shapes of nature—to mathematical formalization. I believe that art might be a privileged way to approach sciences and in particular the formalization of math. I also think that we can start from visually-captivating shapes, expressive configurations, beautiful shapes in nature, to investigate them in light of mathematical formalization.

My "Parametric Natura Morta" (Parametric Still Life) was selected for the Mathematical Art Gallery of the 2018 edition of the Joint Mathematics Meetings in San Diego, California. In this work, I explore the classical Western theme of still life, considering it from the perspective of parametric equations. The initial idea was the following: by defining 3-components parametric equations, a small change of parameter-values produces a visible difference in how equations' graphs appear. By opportunely choosing parameters, as well as colors of the final shapes, we can attribute a different meaning to each image. With a small change of folding and corners, as well as with a different choice of colors, we can create a shell-like shape, a fruit, or a cornucopia. Every single image has been made with Mathematica software, comprised color functions. The obtained images were then superposed via Keynote software against a homogeneous black background. This gives relevance to colors. A "realistic" background would not have been coherent with the recognizable but quite stylized shapes of the objects. In this work, I tried to embody the concept of *abstraction* in mathematics, of *idealization* of shapes.

In my opinion, some classical-art themes, like still life, are still interest-worthy. This could open a debate if there is some math hidden in each natural shape, or if we use math as a filter to understand the world. Maybe both statements are true. According to Galileo, "the Book of Nature is written in the language of mathematics.” And because natural shapes often suggest us beauty, we can guess that mathematics and beauty can be deeply related.

### The Parametric Equations behind *Parametric Still Life*

- Shell 1:

  $[1.2^{u+1}(1+\cos(v))\cos(0.3u)], [1.2^{u+1}(1+\cos(v))\sin(0.3u)], 1.2(1.2^{u}\sin[v+0.01]-0.1\times 1.2^{u}),$

  where $u \in [0, 10\pi]$ and $v \in [0, 40\pi]$;
- Cornucopia:

  $[1.5\times 1.2^{u}(2+\cos(v))\cos(0.3u)], [1.5\times 1.2^{u}(2+\cos(v))\sin(0.3u)], 1.2(1.2^{u}\sin[v]-0.01\times 1.2^{u}),$

  where $u \in [0, 30\pi]$ and $v \in [0, 30\pi]$;
- Lemon: $\cos(u)\sin(v), \sin(u)\sin(v), v$, with $u \in [0, 3\pi]$ and $v \in [0, \pi]$;
- Fig: $\cos(u)\sin(v), \sin(u)\sin(v), v\log(0.1v)$, with $u \in [0, 30\pi]$ and $v \in [0, \pi]$;
- Grape: $3\cos(u)\sin(v), 3\sin(u)\sin(v), 3\cos(v)$, with $u \in [0, 4\pi]$ and $v \in [0, 4\pi]$;
- Peach: $3\cos(u)\sin(v)+1, 3\sin(u)\sin(v), 3\cos(v)+0.3\sin(v)$, with $u \in [0, 4\pi]$ and $v \in [0, 6\pi]$;
- Shell 2: $3\cos(u)\sin(v), 3\sin(u)\sin(v), u+3\cos(v)$, with $u \in [0, 3\pi]$ and $v \in [0, 4\pi]$;
- Leaf: $\cos(u)\sin(v)+1.2^{u}, \sin(v)+1.2^{u}, u+\sin(v)$, with $u \in [0, 2\pi]$ and $v \in [0, 2\pi]$;
- Branch: $\cos(u)\sin(v), \sin(u)\sin(v), v+u$, with $u \in [0, 2\pi]$ and $v \in [0, 5\pi]$.