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RANDOM SCULPTURES

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Abstract
We propose an artistic study of randomness as perceived by the viewer in terms of sculptures designed by means of 3D modelling tools. Two different methods are followed in the design of the shapes: one based on manual manipulations guided by random events, and one based on simulation of a physical system characterized by random parameters. The simulation method adds an extra parameter by which we can study randomness: time. The 3D printing process that gives the computational models of the shapes a physical embodiment adds an extra layer of randomness in terms of structural feasibility.

Keywords
Sculpture
Randomness
Simulation
3D Modelling
3D Printing

1. INTRODUCTION

Randomness has been extensively studied in 20th and 21st century visual arts (Malone 2009), both in terms of paintings (O'Connor and Thaw 1978) and sculptures (Franzke 1988), with (Nake 2012) and without (Morellet 2016) the aid of computers. This proposal aims at adding a new step to the study of randomness in the visual arts, exploring a niche of sculpture in which, from an epistemological perspective, form is meant to express the concept of randomness and, from a phenomenological perspective, form is meant to trigger a sensation of randomness in the viewer.

We chose to work with sculpture rather than paintings to break from the rectangular limitations imposed by canvases or monitors[1] and increase the degrees of freedom that can be affected by randomness.

Within the context of sculpture, and in the subcontext of sculpture affected by randomness, our proposal adds onto what has been done in the past as follows: *we create* objects, as opposed to finding them following the *objet trouvé* paradigm, and the randomness of these objects does not derive from unusual combinations of pre-existing and independent parts, like in many *ready-mades*, but it is embodied in and displayed by their very shape.

However, the different processes we employed to create the sculptures heavily rely upon techniques used in the past, including spontaneous hand movements (following Pollock), throwing dice (following Morellet), exploiting computer generated pseudorandom numbers (following Nake), allowing the laws of physics to shape the objects (following Dubuffet).

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We are aware of artworks made with shaped canvases (Guggenheim Museum 1964). We place them at the intersection of painting and sculpture by considering them either paintings enriched with sculptural properties, or sculptures with one dimension much less developed than the other two. Either way, shaped canvases provide an additional perceptual layer that makes these artworks something more than "pure" paintings.

2. THE CREATIVE PROCESS

We followed two different methods to create the sculptures: *manual manipulation* and *physics simulation*. In both cases we adopted a sphere as starting point.

The manual manipulation method consists of the following steps:

1. Inscribe the sphere in a cube-shaped bounding box
2. Throw a 6-sided dice to pick a face of the box
3. Throw a 16-sided dice to pick one of the 16 points on the selected face
4. Drag and drop the selected point with a spontaneous manual move
5. Repeat until all points on the box have been dragged and dropped at least once

The drag-and-drop move deforms the bounding box, which, in turn, deforms the sphere. Figure 1 shows 2 results of this method.

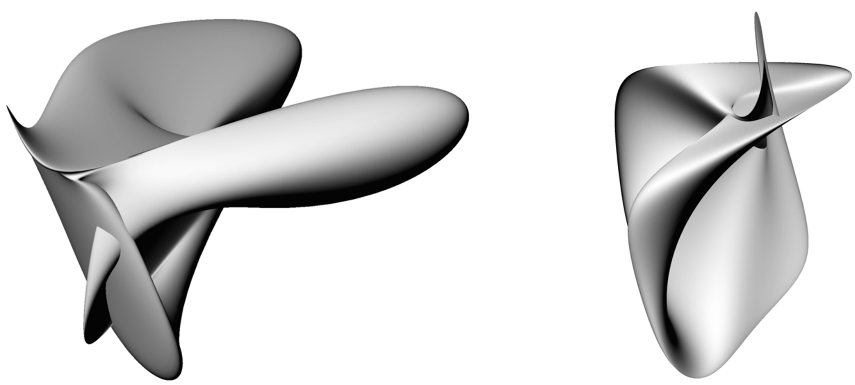

Fig. 1
Random shapes created with the manual manipulation method.

The physics simulation method exploits the computational model of the following physical system:

- The sphere is hollow, and its surface is made of elastic material
- A number of points on the surface is selected randomly
- An equal number of springs is introduced
- For each spring, one end is fixed to one of the points on the surface, and the other end is fixed to a point along the direction that is orthogonal to the surface at a randomly selected distance from the center of the sphere
- The sphere is blocked in its initial position with no deformation, whereas the springs are deformed and have accumulated energy according to the position of their endpoints
- The sphere and the springs are released, and the unleashed kinetic energy goes on deforming the sphere until the equilibrium position is reached

The deformations on the sphere in the physics simulation method provide an aesthetic experience that compares to what obtained with the manual manipulation method. However, it may be argued that here the role played by randomness is more significant. Each move in the manual manipulation method may influence the next one because of aesthetic criteria at work in the human operator. This phenomenon is excluded from the physics simulation method by means of a full automatization of the deformation process.

Moreover, the simulation runs within a temporal interval during which 3D snapshots of the deformed sphere can be taken. The advantage of the addition of the temporal dimension is that we can obtain a number of interesting shapes with a single simulation, as shown in Figure 2.

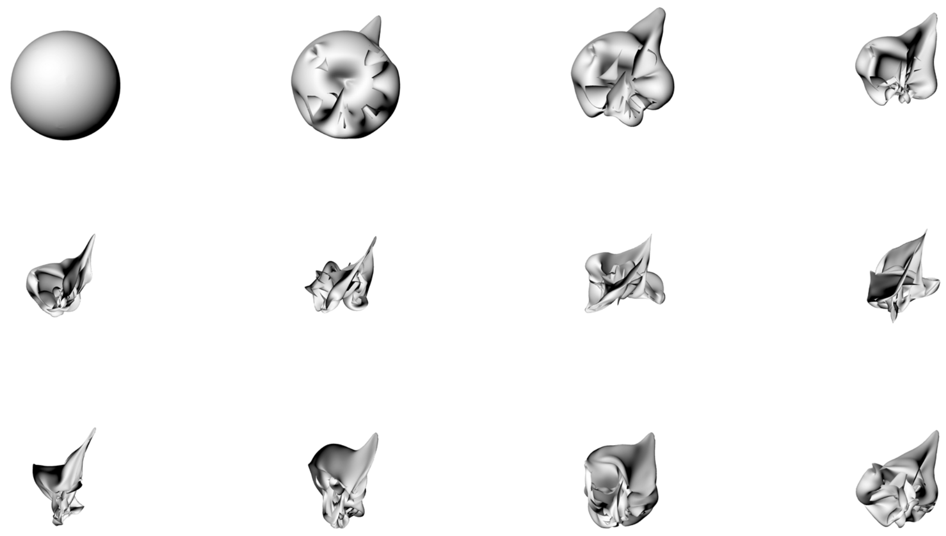

Fig. 2
Evolution of a sphere deformed with the physics simulation method. From the initial state (top left) to the final equilibrium state (bottom right).

3. CONCLUSION

We have proposed a new approach to explore randomness in the form of sculptures obtained with deformations of a sphere within a computational environment. We have conceived two methods, one based on manual manipulations, the other based on physics simulations. They provide similar results, but with slight methodological differences that can continue the debate on the relation between aesthetics and randomness. A fundamental step in this research is to present

3D-printed embodiments of this way of tackling randomness. Not only the printing process will add a further layer of elaboration to these shapes, in terms of warps and collapses of critically thin parts, but it will also allow us to bring the discourse among the audience in the form of a sculpture exhibition.

Acknowledgements: The authors are very grateful to Mattia Agazzi, Matteo Bonasio and Stefano Previtali of FabLab Bergamo for their technical support.

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