

## The aesthetics of imperfection

### Glitch art in three-dimension forms as a creative design tool

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#### Abstract:

Since computers depend on digits and their particular combinations, they explain, resolve, perform everything by numbers. This tendency leads to perfection since the user has to think too much about numbers, units, fractions, ratios, matrices, etc. and this premeditation lessens the likeliness of ending up with accidental developments. Those accidental actions are called “Glitch”.

While glitching as a medium for art is established, there is still much room for discussion on how glitching practice may be carried out. How can we apply accidental errors to form digital three-dimensional forms? is it applicable? in how much those errors can improve creativity and open new paths for three dimensional artists? in what ways may software development, made conducive to this kind of artistic creativity? This paper aims to explore glitching in three-dimensional forms as a creative design tool that can help artists and designers to follow new paths in digital aesthetics.

#### Keywords:

*Glitch Art*  
*Computer Art Aesthetics*  
*Code Softwares*

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#### Introduction

Glitches have become a vital part of computer culture; sometimes diverse phenomena could be perceived as a glitching artworks although it is not glitches if we take it from technical terms. as commonly known that glitches had been always defined as an error, or reduction, or imperfect art (will be discussed later in further). This term had been used commonly in electronic industries and services, among programmers, circuit-bending practitioners, gamers, media artists, and designers. the meaning of glitch had many negotiations and held diverse definition, but we can say that a glitch is an unpredictable change in the system’s behavior, when something obviously goes wrong. That change can arise normally from a function of a program such a low image-processing speed or low bandwidth when displaying video or can be planned and used as a creative artwork. (Olga goriunova, 2008, p. 111)

In recent years, the aesthetics of glitch have grown in both visibility and popularity, with a number of artists adopting techniques for producing glitch in a variety of visual works to both critical and aesthetic ends (Gaboury, 2018, p. 485)

#### Related works

##### Glitch art

Glitch Art is often aestheticized and fetishized technological (human) errors or anticipated accidents that can produce unintended (desired) results. Originally, a ‘glitch’ refers to a false electronic signal that has been caused by a short,

unexpected surge of electric power. Glitch have many forms, such glitch music which is created using electronic instruments that have been altered in a process called ‘circuit bending’, whereby electronic parts are removed or short-circuited. Other forms of glitch music originate from a variety of techniques that are labelled ‘data bending’, taken from the hardware equivalent ‘circuit bending’. In data bending, digital data is manipulated in unexpected ways to create surprising, novel output. The idea of altering a digital component to influence the analogue output soon travelled from the music domain to the visual domain. Visual glitch art also uses ‘data bending’ whereby artists and programmers use hex editors to open digital images, alter the binary content (often at random), save the result and view the visual effect. (Heijir, 2013, p. 112) . There are few scientific publications on the topic of Glitch art, but there are some very useful online tutorials. Several authors have suggested that the name ‘Glitch’ is a misnomer, since many glitch artists deliberately manipulate digital content, and do not rely on accidental errors, or glitches.

In our paper we present a number of basic glitch practices that commonly practiced by artists. We use these practices to shade light on new techniques on code manipulation in order to achieve a design toll for three-dimensional form.

#### Backgrounds

Perhaps one of most essential question that came to mind that is Glitch Art actually Art? But isn’t

any new medium having its suspensions at first? I mean it happens before with the idea of abstraction in general.

By going back to the beginning of modern art history, it can be found that the introduction of photography in the nineteenth century forced new questions into the domain of painting and art-making. Photography could achieve in a fraction of a second what took hours to paint or draw, and thus painters sought new directions for their practice. We can see that critics at this time look to abstraction as it lowers aesthetics, particularly the rectangular forms of de Still works like Mondrian's earlier composition pieces and some Bauhaus or Expressionist works of Klee, Rothko, and Kandinsky. These artists avoided direct visual representations of figurative reality, in favor of experiments in spontaneity, absolutes, or studies in form, color, or shape. Glitch art, however, is fundamentally representational in concept, since most glitches are direct depictions of (mangled) data. (Downey, 2002).

If we chase the concept of glitch, it can be found that it goes back to evolving machine in art history. In the beginning of twentieth century Avant -Garde artists had admired machine, specially some early art movements as cubism, futurism, supermatism, Dadaism .... Etc.). Avant-Garde artists have poeticized new machines for their speed, energy, and dynamics admired by movement, light power and speed, and dealt with those characteristics of machine as a new aesthetics.

It can be found that analytical cubism analyzed natural forms and reduced the forms into basic geometric parts on the two- dimensional picture plane. This analysis and concept of reduction can be easily compared to the process that an algorithm executes when encoding a media file. In this way glitch art is like Cubism. (Brize, 2011, pp. 55-56). The images of Futurism, as well , taking inspiration from the speed and movement of the motorcars and machines of the industrial era. Examples of this revised aesthetic include Giacomo Balla's *Dynamism Of A Dog On Leash* (1912), Carlo Carra's *The Red Horsemen* (1913), and Umberto Boccioni's sculpture *Unique Forms of Continuity* (1913), all of which attempt to compress multiple perspectives and temporalities into a single image- space (Carolyn I, 2014) .

In the postwar period, the Duchampian legacy of chance, glitch, critique, and appropriation finds expression in the work of a number of modern artists. This includes key players like Jackson Pollock, Robert Rauschenberg, John Cage, various Fluxus artists,

Jasper Johns, and Ed Keinholz, among others, all of whom position art as either a process- based aesthetic or as a dematerialized form awaiting actualization by a spectator. Perhaps that can be noticed in the 1960s, when Fluxus artists produced anti-expressionistic, anti-museum artworks that included happenings, chance, experimental music, and audience participation. (Carolyn I, 2014)

Early net art artists such as the European art collective, Jodi, have, since the 1990s, used markup languages and videogame modification as platforms for disruptive play). This interest in shattering the illusion of a medium by laying bare the processes and materials that produce its technical form is a longstanding tradition in modernist art and the avant-garde. Nonetheless, the glitch offers a unique engagement not simply with the specificity of its medium, but in its negotiation with failure as unexpected transformation in the function of computational devices. (Gaboury, 2018, p. 485) .

Since computers depend thoroughly on digits and their particular combinations, they explain, resolve, perform everything by numbers. This tendency leads to perfection since the user has to think too much about numbers, units, fractions, ratios, matrices, etc. and this premeditation lessens the likeliness of ending up with accidental developments. "It is failure that guides evolution; perfection offers no incentive for improvement" said Colson Whitehead in 1999. Alternatively, "Leonardo Da Vinci insisted 'that painter who has no doubts will achieve little', and he advised artists to seek out inspirations for their paintings in the stains on walls" . (German, 2008)

in the same context Olga Goriunova and Alexei Shulgin negotiate about the machine admiration that had been held by avant-garde artists , with machine functionality, as machine produced distinct aesthetics , in their discussion they asserted on the value of "dysfunctionality "as a strike against machine perfection. They saw that this imperfection takes art once more to humanistic level. they discussed that in the technological era, society became organized according to the logic of machines, conveyor belt principles, "rationally" based discrimination theories, and war technology, with an increase in fear, frustration, refusal, and protest. As a response, errors, inconsistencies of vision, of method, and of behavior become popular modernist artistic methods used in Dadaism, Surrealism, and other art movements. What they mean by Dysfunctional machines was not only broken images and figures of crashed cars and other mass-produced imperfections figure in the

aesthetics of Fluxus and Pop Art; but also, those that do not comply with the general logic of machines, by acting irrationally and sometimes even turning into humans. (Olga Goriunova, 2008, p. 111).

### Definition

Standard dictionaries fail to define the word “glitch” except in relation to analog technology. The first documented usage in English belongs to John Glenn, in reference to voltage modulations encountered during an early manned space flight. (Hugh S Manon, 2011, p. 1), it has been also defined in dictionary.com as A minor malfunction, mishap, or technical problem; a snag; a computer glitch; a navigational glitch; a glitch in the negotiations. The term ‘glitch’, and what it has come to represent within digital culture, forces the term to be an umbrella for all sorts of digital, electrical and new-media artefacts which may or may not be at odds with the intended *meaning* of the word. (Austin, 2017, pp. 551-560)

Perhaps one of the most accurate approaches in defining “glitch” was offered by Iman Moradi in 2004, when author described two different terms that delineate the most popular related approaches of glitch. First term is the “Pure Glitch” Is the result of a Malfunction or Error. He argued that “pure glitch” is more related to a theoretical, scientific and non-art sense, a glitch is assumed to be the unexpected result of a malfunction. As previously mentioned word glitch was first recorded in English in 1962, during the American space program, namely in the writings of John Glenn where it was used to “describe the problems” they were having. Glenn then gives the technical sense of the word the astronauts had adopted: “Literally, a glitch is a spike or change in voltage in an electrical current.”. On the other hand, he offered definition to what he call a “Glitch-alike” in which he described it as “a collection of digital artefacts that resemble visual aspects of real glitches found in their original habitat. (Moradi, 2004, pp. 8-10). Iman Moradi, one of the first to discuss the term glitch as an art genre, tries to separate technical from constructed glitches and ends up categorizing them according to their final visual outcome. Hence, he employs the terms *pure glitch* and *glitch-alike*. For him, *pure glitch* is only the one that emerges unexpectedly, due to a malfunction or change of voltage that inhibits electrical flow. Therefore, it is not intentional, but it appears accidentally, as it is triggered by machine-made errors. *Glitch-alike*, on the other hand, is referring to a ‘constructed’ glitch, or a man-made ‘error’ that is being re-appropriated as a creative practice. (Sortiraki,

2014, p. 25)

In this paper we will be dealing mostly with practices of “pure glitch”, in further paper will investigate 2 dimension and 3 dimensional artworks from different approaches.

### Visual Characteristics of Glitches

Moradi offers visual characteristics for glitch, namely *fragmentation*, *linearity*, *horizontality* and to a lesser extent *complexity*, have been consistent features in the production of glitch art over the past decade.

- **Fragmentation:** it is more like tearing an image and then pasting it in another areas, which is usually horizontally. These fragmentations may also result in splinters and sharp contrasts of color between two distinct regions of an image. It can also relate, to mistranslation. Dramatic tonal changes also affect an image’s mood and can be seen as a form of fragmentation.
- **Repetition:** it is using an image as a pattern more like a digital “wall paper” images and because a Glitch effect is unanticipated and sometimes coincidental, any kind of regular repetition appearing in the equation makes it quite complex.
- **Linearity:** In the majority of cases, whenever visual information is being recorded or is transferred from one medium onto another, it is broken down to its individual components. Without going into any level of technical detail Those individual components can be pixels, color separation layers, or graphite granules on paper. In some glitches, these elements (pixels) tend to merge with each other in rows to form lines.
- **Complexity:** Glitches can also surprise us with their complexity. Sometimes changing a few variables affecting a simple design element on computer can cause a crash and a visually pleasing glitch to occur. However, this computer-generated ready-made complexity worries some glitch artists who fear this makes their work easily brandable, or indistinguishable from digital trash. (Moradi, 2004, pp. 29-33)

On the other hand, Menkman offered another approach in which she discussed how viewer perceive glitch art. she explained what it called ‘the glitch moment(um)’. For Menkman (2011), a glitch is the embracement of the subjectivity of the viewer. Menkman explains:

“Through the distorted images and behaviors of machinic outputs, the viewer is thrown into a riskier realm of image and non-image, meaning and non-meaning, truth and interpretation. The

machine no longer behaves in the way the technology was supposed to...Though at first the viewer reacts with shock and perceives the experience as a loss, the glitch cannot be subdued as a solid state of perception. Just as the understanding of a glitch changes once it is named, so does the notion of transparency or systemic equilibrium supposedly damaged by the glitch itself. The 'original' experience of rupture is moved beyond its sublime moment(um) and vanishes into a realm of new conditions. The glitch has become a new mode; and its previous uncanny encounter has become to register as an ephemeral, personal experience of a machine. (Menkman, *The Glitch Momentum*, 2011, p. 31)

### Three- Dimensional glitch practices

In my search for collecting data for the topic, I found limited studies that concern with glitch art, so far, the discussion of glitches has been limited to the two-dimensional visual domain. Very limited studies were concerned with glitch techniques representation in actual world.

Rosa Menkman once mentioned that "Once the glitch is understood as an alternative mode of representation or a new language, its tipping point has passed and the essence of its glitch- being is vanished. The glitch is no longer an art of rejection, but a shape or appearance that is

recognized as a novel form (of art)." (Menkman, *Glitch Studies Manifesto*, 2011, p. 341) As growing of open sources software that enable artists to examine more opportunities, it can be found that glitch practices differ in last decade technically and conceptually and with growing hope to see glitch techniques in the physical medium increased. In the following examples of 3d glitching we are going to introduce some of familiar practices used in 3D glitching.

### Misalignment

Misalignment can happen easily between a digital file and the software that reads that file has two mirror-like variants: For example, opening a motion-encoded video file as audio, manipulating the audio-version of the dataset, then engaging the results either as audio, or returning it to be video again. Both these approaches involve mismatches between encoded data and its decoding, resulting in aberrant results when rendered for a human audience. (Betancourt, 2017) those kinds of techniques can be shown in Banksy artwork mermaid located in his controversial 'Dismaland' exhibition embodies a corrupted image of the familiar Disney Princess in a 3d physical sculpture. From all angles the 3d sculpture remains to read as if presented as a corrupted digital file on a flat digital screen.



Figure 1 : Banksy , Mermaid , 2013

I remember first samples I have seen on the internet about 3-dimensional glitch I have seen many ideas that was really motivating , among one of them was furniture by Ferruccio Laviani's designs , when laviani stretch and bend the boundaries of interior design with "glitchy" furniture for a product series called Good Vibrations. In an interview with *Sight Unseen*, Laviani speaks of his inspiration to warp his Neo-Renaissance designs, stating, "I wanted to join these two ideas that seem to fight against one another: The quality of the craftsmanship and the low-quality image distortion. When you join these two things that are so opposite, it's interesting and

funny." ( electronic source 18 )

### Distortion

It is known as mechanical faults and failings, it is one of the most common technique , and at the same time, the most transient. They reside in the particular device itself rather than being a feature of the data displayed. "Glitch" techniques align with particular sites of technological manipulation, yet all of them share an underlying engagement with the unexpected and aberrant behaviors of machinic systems proceeding autonomously. (Betancourt, 2017)

One of this technique famous example was when axisVFX was called upon to help create a race of

two-dimensional-like creatures called the Boneless in the *Doctor Who* 'Flatline' episode, they drew inspiration from, surprisingly, glitchy and failed 3D printed objects as well as sea slugs. fxguide talks to axisVFX visual effects supervisor Grant Hewlett, creative director Stuart Aitken and lead effects artist Joe Thornley-Heard about their work for the BBC show.

Dubbed 'distortion zombies', the Boneless in their human-like forms went through several design incarnations while axis VFX collaborated with director Douglas Mackinnon and VFX art director

Ste Dalton on the look. "One of the early bits of reference we looked at was 3D printing that had gone a bit wrong," relates axisVFX visual effects supervisor Grant Hewlett. "It was tied in to the idea that they would be permanently connected to the place they were born - so it suited the story that they couldn't just suddenly chase after people and get to them very quickly. So, they had to constantly re-draw themselves, but they weren't very good at that so that's where the distortion and pieces missing came from." (electronic source 21)



**Figure 2 : Ferruccio Laviani's , Glitch furniture Pixelization**

Pixel sorting is only one of the many practices that glitch artists engage in for the intervention of digital images. Another popular practice is data bending. The concept "data bending has its origins in a technique developed in the 1970s known as circuit-bending, an approach that "takes found objects such as battery-powered children's toys and inexpensive synthesizers and modifies them into DIY musical instruments and homemade audio generators". Similarly, data bending involves using software with the intention of disrupting a file at the raw data level. (Ernesto Pena, 2017, p. 90)

Luke Jerram modelled a 3d pixelated portrait of his daughter Maya. From afar the pixelated sculpture can be easily read but as you get closer the lack of detail is apparent. The work deals with ideas around perception, optical illusions and the digital age we live in. (Haslop, 2016, p. 41)

The artwork was made by scanning Mr. Jerram's daughter using an Xbox Kinect. Her head was scanned at the Machine Vision Laboratory at the University of the West of England where Mr. Jerram is a visiting Senior Research Fellow. Both scans were then combined and pixelated into



**Figure 3 : Douglas Mackinnon , Distortion zombies**

cubes, called voxels. The model was then made from precision-cut sheets of aluminum. Finally, more than 5,000 colored stickers were printed and fixed on to the aluminum. The sculpture is part of a series of Bristol Temple Quarter Commissions, designed to engage people with the new Temple Quarter Enterprise Zone. The aim is to encourage artists and audiences to explore the area, engage with its history and its future. (electronic source 17)

### Data Manipulation

Data manipulation covers a range of approaches and protocols, all of which are focused on the transformation and alteration of the digital file itself: its dataset is changed to induce aberrant results when "played" normally on a computer. These varieties of glitching are the most immediately recognized as being glitch, and are readily apparent as specific, named protocols such as "data moshing" Direct transformations of data to introduce errors and overflows when the file is rendered for a human audience overlap with transformations of the data using incorrect and inappropriate software, resulting in convergent results when encountered in human readable form. (Betancourt, 2017) in his series *Digital Natives*,

artist Matthew Plummer-Fernandez reimagines glitches as fantastical kitchenware. He scans teapots, vases, and bowls and distorts their images using custom software, and then 3D prints them in colored resin, reconstructing abstract, polygonal objects that look like "new primordial forms that begin to resemble early human artefacts."

The objects are based on 3D scans of a watering

can, a Power Ranger action figure, a spray bottle, a dolphin-shaped lamp and a 19th century vase. The designer used custom-made software to subject the scans to algorithms that stretch and distort the data into new forms, before sending the altered files to be 3D printed with colorless sand particles and tinted resin. ( electronic source 19 )



Figure 4: Luke Jeram , Maya



Figure 5: Digital Natives, By Matthew Plummer-Fernandez

**Using Codes to build three- dimensional glitches**

In recent years, the aesthetics of glitch have grown in both visibility and popularity, with a number of artists adopting techniques for producing glitch in a variety of visual works. Matthew Austin once discussed in deep two types of algorithmic transformations. "pre-encoded transformation ", these transforms operate on what the information represents. For example, image filters the most famous type for image transformation, it had been used with graphics programs and world widely known, it is manipulating the linear sequence of characters on the computer drive that represents the image in order to produce the desired effect. The second type of transform is the 'encoded transform'. These transforms act with no regard of what the information represents. For example, rather than using an image filter an image may be distorted by manipulating its binary, hexi-decimal or ASCII representations. Encoded transforms operate upon the information and thus not what

the information represents leads the formal outcomes of such processes unpredictable. (Austin, 2017)The conceptual importance of this distinction between pre-encoded and encoded transforms is that the encoded transform embeds within it all glitch processes. All glitches, whether natural or synthetic are born through an encoded transformation of some sort with the exception of individuals using pre-coded transforms with the intent of producing a glitch aesthetic.

At first of my research , and while I had been fascinated with glitches , I tried a lot of image encoded transformation , but I was not sure that I could do use codes to produce 3 dimensional form , off course there are a lot of software that can produce 3D , like 3D max for example but I was searching to produce forms build in codes not filters or just linear deformation , there when I started knowing grasshopper in rhino .

**Grasshopper as a three-dimensional form design tool**

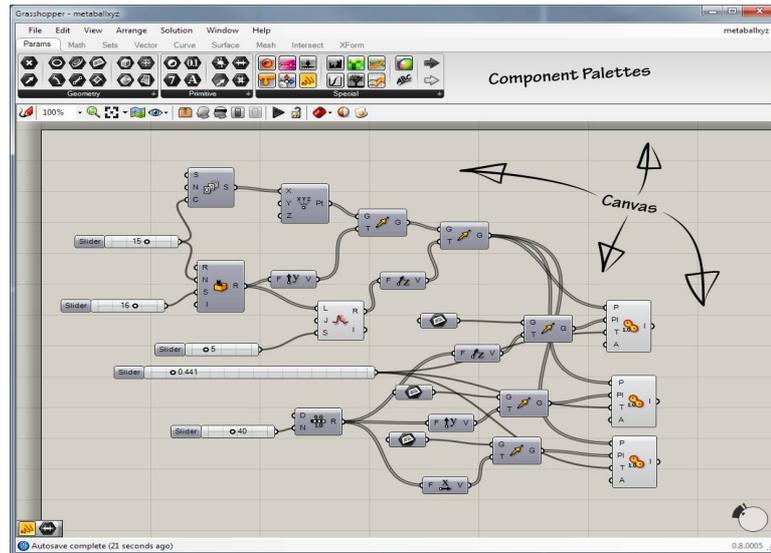


Figure 6: Grasshopper interface

Grasshopper is a visual programming language and environment developed by Scott Davidson, David Rutten at Robert McNeel & Associates, that runs within the Rhinoceros 3D computer-aided design (CAD) application. Programs are created by dragging components onto a canvas. The outputs to these components are then connected to the inputs of subsequent components. Grasshopper is primarily used to build generative algorithms, such as for generative art. Many of Grasshopper's components create 3D geometry. Programs may also contain other types of algorithms including numeric, textual, audio-visual and haptic applications. Advanced uses of Grasshopper include parametric modelling for structural engineering, parametric modelling for architecture and fabrication, lighting performance analysis for eco-friendly architecture and building energy consumption. The first version of Grasshopper was released in September 2007 and titled Explicit History. Grasshopper has become part of the standard Rhino toolset in Rhino 6.0 and later. (electronic source 20)

grasshopper is a set of user objects which enable a wide range of mesh editing, creation, interaction, and topology modification within Grasshopper 3d. Code had been developed in 2014 by machine histories studio in which this user object takes an input mesh and reorganizes it based on some various math operations. You can select which values define the X, Y or Z positions of the vertices, you can select to apply sin/cos, you can select to multiply it by X , Y or Z, you can select to add X Y or Z, and you can select to multiply this by an additional value. It also outputs the formula, so you can evaluate the selections you've made. ( electronic source 22 )

As provided by photos ( fig : 8 ) , it can be can see from the formula that results from mesh glitch had given the same practices that we have discussed previously, but the most important that those forms as made in the same techniques that glitch image produced, by encoded transformation as discussed previously . However, grasshopper is just designing tool, it can be manufacture by printing forms with 3D printing techniques.

Mesh+ that found in a list of commands of

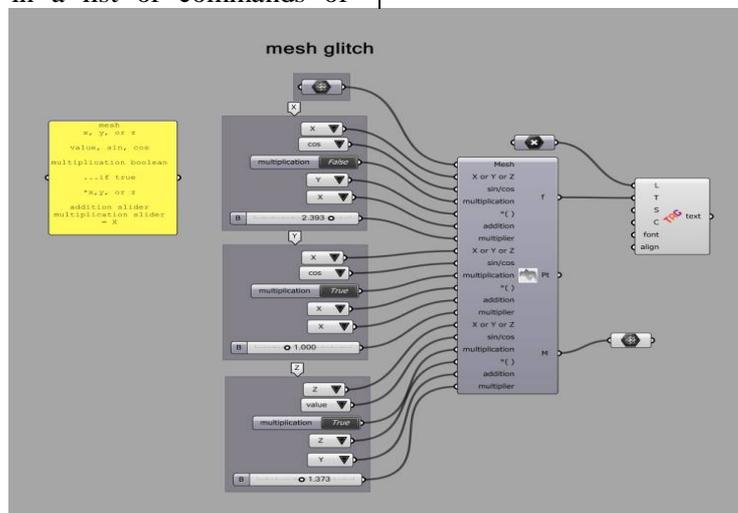
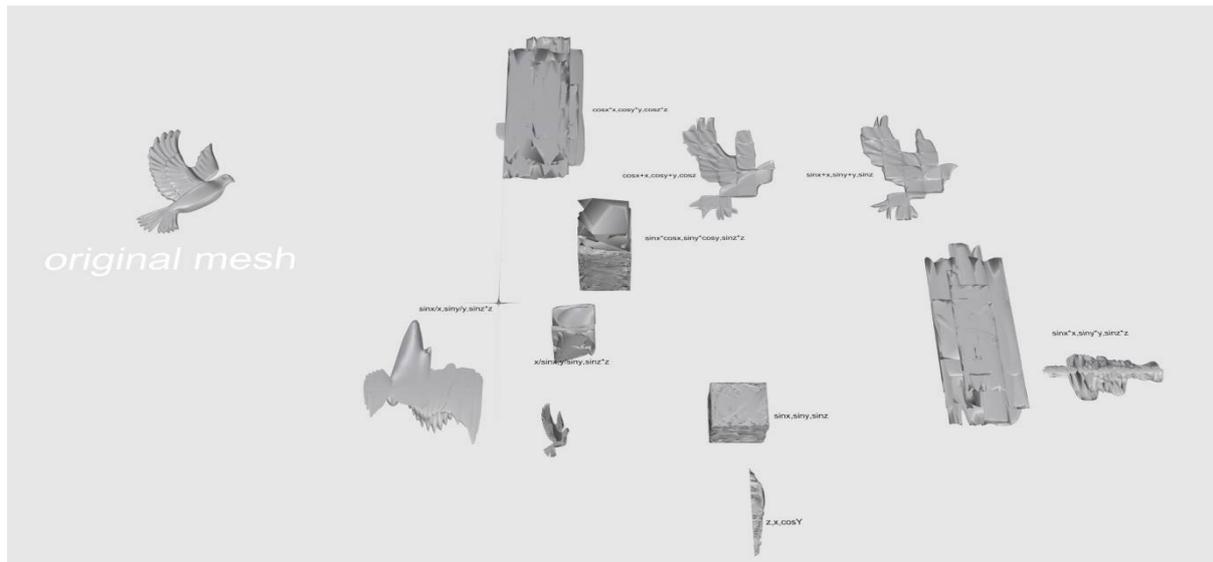


Figure7: Mesh Glitch formula, Grasshopper





**Figure 8 : Mesh Glitch formula, results**

### Conclusion and future works

Glitch art is a recent form of digital art and can be considered an umbrella term for a variety of techniques that manipulate digital images by altering their digital encoding in unconventional ways. It is often known as a technological human errors or anticipated accidents that can produce desired results. Glitch art be best known from its role in electronic music, but it had been explored in two-dimension image, as an accident rather than a natural occurrence, to form a digital composition. Artists have started to explore glitch in three dimensional, and in physical space as well.

In this paper, we presented a new tool for designing 3-dimensional glitches art and design works. Shade light on most familiar glitch practices, with analyzing to those practices. It aimed to help young artist with new concepts and mediums to produce art, in order to improve innovation in the field of art and design. The future works will concentrate on how designers get inspiration from glitch art practices and how they create their own designs by investigating deeper in grasshopper capabilities and new software that could help in glitch art field.

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