

Soojin Lee

Prof. Michael Shiloh

Machine Lab - Interactive Media

14 March 2023

Wintergatan's Marble Machine: A Symphony of Music and Engineering

For four minutes and thirty-three seconds, I was completely immersed in the mesmerizing world of the Marble Machine. This giant instrument, created by Martin Molin, the Swedish artist and founder of Wintergatan, features continuous cranking, lever flips, and racing marbles. The intricate machine generates an extraordinary combination of art and engineering that produces unique and captivating music. The video of the Marble Machine has captured the attention of over 225 million viewers, as 2000 steel marbles ride through its sound-producing pathways. In this paper, I will delve into the history, design, and mechanics of the Marble Machine, examining its significance not only to the world of music and engineering, but also to me personally.

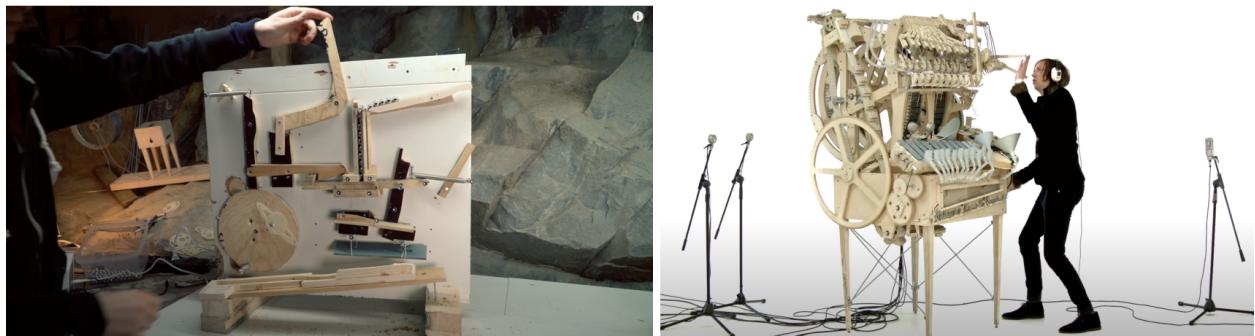
Inspiration:

Martin Molin was inspired to create Marble Machine by his desire to produce something new and unique in the world of musical instruments. As a musician, Lego enthusiast, and the founder of the band Wintergatan, Molin had a deep passion for music and wanted to explore unconventional ways of creating it. As all great artists do, Molin drew inspiration from other artists and innovators, such as Matthias Wandel, who had used marbles and gravity to produce unique sounds (fig 1). Molin then took this to a whole new level by creating a beautiful and functional machine.



Matthias Wandel's Marble Machine (fig 1)

Similar to how we built hand-crank mechanisms using cardboard boxes in class, Molin started with a simple-crank mechanism prototype built using readily available materials in his workshop (fig 2 left). He then continuously iterated until he achieved an intricate instrument (fig 2 right). Marble Machine now incorporates features such as a programmable music box that allows for complex composition by adjusting the position and timing of gears and levers. In the next section, we will explore the design and workings of this machine in more detail.



Wintergan's Marble Machine First Prototype and Final Piece (fig 2)

Design and workings:

The Marble Machine is made primarily of wood pieces and consists of several components, including motors, a set of gears, a series of levers, and a collection of marbles. It is manually operated using a hand crank. The device raises steel marbles and sends them through a

series of feeder tubes. Programmable gates release the marbles from different heights, causing them to strike an array of musical instruments below, such as a vibraphone, bass guitar, and cymbal. Contact microphones are used to emulate sounds from a kick drum, hi-hat, and snare drum when the marbles hit them (figure 3, left).



Wintergan's Marble Machine Drum mechanism & Musical Composition (fig 3)

Then the musical composition is programmed onto two wheels, which are constructed using Lego Technic beams and stud connectors. The wheels activate armatures that release the marbles in accordance with the programmed score. The marbles are released from the top of the machine and travel through the tubes, hitting various objects along the way, such as xylophone bars, cymbals, and a bass guitar. The objects are arranged in a specific way to create a sequence of musical notes when the marbles hit them (fig 3 right).

While there are many different mechanics used in this project to generate the sound and move marbles, I was especially fascinated by the marble divider, which is responsible for equally dividing the marbles coming in on four channels (fig 4). The video “Why 99% is NOT Enough - Marble Machine X Accuracy test” visually explains the evolution of this feature, the marble divider, as well as the importance of precision and resilience in designing and constructing intricate machines the Marble Machine.



Marble Divider Version 1 (fig 4)

Molin uses the marble divider device that gets stuck over time as an example to explain the importance of designing for durability. If the machine is not carefully made, it may work initially but eventually break down (fig 5). Using the first version of the divider, he demonstrates that instead of dividing marbles equally into four channels, channels one and two receive more marbles than channels three and four. This imbalance eventually causes the marbles to get stuck in the pipe, leading to the machine's breakdown.



Imbalance leading to breakdown (fig 5)

After a few iterations, Molin came up with a genius solution that remains the core mechanics and principles of the machine. By adding simple plastic rocking flip and flop features

at each dividing path, Molin was able to control the flow of the marbles and make it more uniformly distributed throughout the machine.



Initial version versus rocking flip and flop version (fig 6)

This solution was elegant in its simplicity, as it did not require overengineering or breaking down the entire machine. When tested with the new version of the four dividers, the result was amazing, with the marbles being divided equally and flowing smoothly throughout the entire Marble Machine. The simplicity and resourcefulness of Molin's solution to this marble divider that controls the flow of Marble was really impressive for me. Furthermore, it represents the beauty of practical design and engineering which utilizes uncomplicated methods and physics to address challenges. His approach demonstrated that effective solutions do not always require complex designs but can result from creative thinking - which I hope to achieve when working on a clock mechanic project.

Significance

Wintergatan's Marble Machine is significant not only for the project itself but also for the broader community of artists and engineers including myself. Martin Molin's use of YouTube as

a platform for sharing his knowledge and design process has made the project an important educational resource for those interested in engineering, music, and interactive media art. Molin's effort to document and explain the mechanisms behind the artwork in a way that is accessible to non-experts is especially admirable, and it has inspired many people around the world to create their own projects. Molin's comment that "If it looks professional, I learned it on YouTube" speaks to the power of sharing knowledge and highlights how we may leverage the resources online to absorb skills to bring imagination to reality. In sum, The Wintergatan's Marble Machine project that is at the intersection of technology, art, music and community represents the very essence of interactive media arts and it has inspired me greatly as well.

Works Cited

Wintergatan. “Wintergatan - Marble Machine (music instrument using 2000 marbles).” YouTube, uploaded by Wintergatan, 2 Mar. 2016,
<https://www.youtube.com/watch?v=IvUU8joBb1Q>.

Wintergatan. “How It Works - Part 2 (Wintergatan Marble Machine)” YouTube, 6 March 2016, https://www.youtube.com/watch?v=p0Guq7vZb_E

Wintergatan. “Why 99% is NOT Enough - Marble Machine X Accuracy test” YouTube, 10, May 2021, <https://www.youtube.com/watch?v=b0kzTgz-y4Y>