Série des catastrophes: Visualizing dynamic parameters in Faraday Wave Patterns

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Requirements

Purpose: To simulate and visualize Faraday wave patterns in a digital audiovisual environment, emphasizing the dynamic effect of catastrophe types on pattern morphology. This tool utilizes Processing, a Java-based programming environment, to create an interactive visualization of Faraday wave patterns.

Audio-Driven Visualization with live metrics: This three-dimensional representation of wave patterns integrates music I wrote and produced in the form of a .wav audio file with varying dynamics that are mapped to multiple variables. Metrics are as follows; Amplitude represents the dB value of the loudest frequency, frequency shows the loudest frequency (Hz) in the mix at any given time, and cell diameter is displayed in pixels (px). Displaying these values live gives users insight into how different elements affect pattern morphology.

Dynamic Control Potentiometer: This control mechanism allows users to perform real time adjustments to the temporal interval of catastrophe type selection. This range is from 10ms to 5000ms which allows users to closely examine the effects of different catastrophe types or rapidly change between them.

Catastrophe Type Display: This shows the type of catastrophe (e.g., Fold, Cusp, Swallowtail) at the center of the visualization, dynamically changing with audio input and control adjustments. The inclusion of these formulas also gives users insight into the fundamental mathematics the sketch is based on, making it both creatively engaging and academically challenging.

Additional Features: Also included is a brief [powerpoint](#) explaining Catastrophe Theory as proposed by French topologist René Thom in the 1960's along with other cultural contexts.

Other Notes: The sketch folder also includes alternate self produced audio files if the user would like to see how it reacts to additional files. Please note for this some modifications to the code (for the audio filename) would be needed as it is only set up to work with the prescribed file in its current iteration. This is simply there for those who would like to explore more and is not a necessary requirement. In theory there could be a long string of files that would then generate an automatic animation that would be continuously dynamic and unique.

Reflections

This sketch was initially designed to creatively demonstrate the key takeaways of a research publication on Faraday waves authored by Sheldrake and Sheldrake. In this initial context the sketch was developed to stay as close as possible to the research without taking much creative liberty. However it was a challenge to produce wave pattern morphology that was as detailed and complex as in the original paper. Because of this, the animations do not exactly represent photorealistic versions of Faraday waves in oscillating water samples but they come as close as they can given the scope and nature of the programming environment and assignment. Despite this, of the seven fundamental catastrophe types (Fold , Cusp , Swallowtail, Butterfly, Hyperbolic Umbilic, Elliptic Umbilic and Parabolic Umbilic) it is clear that Cusp and Swallowtail produce the most dramatic pattern morphology. What was fascinating while working on this was that upon further research it became apparent that Salvador Dalí's final painting *'The Swallow's Tail — Series of Catastrophes'* prominently displays the four dimensional graph of exactly these two catastrophe types. In other words while creating this sketch I came to the same conclusion Dalí had , that an immense amount of dynamic aesthetic value can arise from relatively simple mathematical formulas. This shows how brilliant Dalí was even at the last moments of his professional career and really helped link the artistic and scientific sides of this project together. For future work I would like to add more user controls, for example an ability to change the wave color or the audio file dynamically which would potentially make the project even more appealing to a wider audience not familiar with the theory or artistic inspirations. Additionally I plan to combine the powerpoint along with a visualization demonstration into a mini-lecture-exhibition that will be published on YouTube and other platforms later this year. Lastly I would like to add that my teammate in the Playful and Creative Science course Amber van der Tuin originally inspired the sketch by providing the Sheldrake and Sheldrake paper along with giving some user feedback while I wrote the code.

Source Code (google drive), also in the zip folder.

Instructions

1. **Unzip** the main folder and open it
2. Open Processing and make sure to have the **minim** (audio playback) and **controlP5** (user control) libraries installed to ensure sketch functionality.
3. Navigate to "**CPFinal_Draft2.pde**" inside the folder and run it in Processing, if it does not load or has excessive latency, then stop the sketch and replay it.
4. The main sketch window will populate along with a separate '**Control Window**' which displays a digital potentiometer that lets the user control the Catastrophe Selection Change Interval from **10ms - 5000ms**. Clicking and dragging with the cursor clockwise increases the change interval time; the user can also click on different points on the dial to rapidly shift intervals. This effectively makes the tool an audiovisual instrument.
5. The audio will loop continuously until the sketch is stopped
6. For exploration with more audio files see the **.wav assets** in the main folder.

Output Example Videos ([Dynamic]) , ([Static])

References

Sheldrake, M., & Sheldrake, R. (2017). Determinants of Faraday Wave-Patterns in Water Samples Oscillated Vertically at a Range of Frequencies from 50-200 Hz. *Water, 9, 1-27*. https://doi.org/10.14294/water.2017.6

Salvador Dalí (1983). Swallow's Tail and Cellos, Catastrophes Series. Salvador Dalí Foundation. Retrieved January 18, 2024, from https://www.salvador-dali.org/en/museums/dali-theatre-museum-in-figueres/the-collection/114/untitled-swallow-s-tail-and-cellos-catastrophes-series