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## Introduction

It was UPIC's novel approach to drawing sound that first attracted me to Xenakis' system. As an artist with a background in drawing, sculpture, sound and computing, the idea of a musical instrument that allows one to use a pen to draw and manipulate waveforms and immediately hear the results had a magical quality that led me to explore it further.

Much contemporary digital music creation is mediated through menus and submenus. By prioritising infinite choice over immediacy, we have arguably made electronic music composition more intimidating, disembodied, and detached from physical expression.

The UPIC Ludique strips Xenakis's original vision down to its rawest, most democratic elements and reimagines this large laboratory project as a simple, portable, toy-like physical instrument.

Developed by Iannis Xenakis and collaborators at CEMAMu (Centre d'Etudes de Mathématique et Automatique Musicales) from the mid-1970s, the UPIC was a computer-based compositional system that transformed drawing into sound. It was an attempt to take control of all aspects of sound and to radically move away from the confines of acoustic instruments. Using a large graphical interface, composers could work at the micro level of drawing waveform shapes and envelopes and move to the macro level of drawing entire compositions. Its design drew as much from architecture and visual art as from conventional musical notation, positioning the system somewhere between notation, composition and instrument.

UPIC was also conceived as a pedagogical tool, encouraging direct and exploratory engagement with sound. It was not a single, fixed instrument but an evolving research project, with successive artists and developers adapting its hardware and software to changing technological possibilities. This combination of visual interaction, direct sound manipulation, pedagogy and technological experimentation is central to my interest in the system.

In this article, I describe the development of the UPIC Ludique, a reinterpretation of UPIC as a portable, deliberately constrained and child-friendly digital musical instrument. Rather than attempting to reproduce the original system, the project explores what might happen when some of UPIC's underlying principles are reduced to a simple, toy-like physical interface. The

article documents the instrument's development and use through images and video and considers the ways in which constraint, immediacy and play might shape musical exploration.

## Context and Design

The original UPIC was built around a computer, display, speaker and a large drawing easel. The interface and software were organised around several graphical elements operating at different levels of musical organisation. At a micro level, individual waveforms could be drawn and stored, while amplitude envelopes could be drawn to control the volume profile of a sound. The Page provided a compositional space, with the vertical axis representing pitch and the horizontal axis representing time. A Sequence recorded the performance of a Page, capturing the movement through the graphical composition over time, including changes in tempo and position. Although clearly complex, particularly for its time, the instrument also developed from a desire to make musical processes more accessible, tactile, and visible. As Xenakisnoted:

“You don’t need any musical knowledge to use the table, and in fact it also serves as a pedagogical tool. We’re visited regularly by schoolchildren of seven or eight years of age, accompanied by their teachers. They draw fish, houses, trees—and can hear the result.” (Xenakis and Varga 1996)

“Xenakis imagined that even children could make such drawings and familiarise themselves with the (computer-assisted) sound results. He assumed that musical creativity is not only a privilege for the few, for example, only appreciated and promoted by specially trained people, but rather a broad potential without limitation based on individual age or educational levels.” (Xenakis and Varga 1996)

Xenakis further argued that “the use of existing instruments reinforced the social and political system from which they came and thus trapped the user into a sense of false liberation.” He also “consistently stated to the press that the system (the UPIC) should not only be included in every classroom but that every person should own one as well.”

The extensive documentation surrounding the project illustrates the degree to which Xenakis developed and promoted this vision. The system was also introduced into educational contexts in France, underlining its potential as a tool for exploratory musical learning, as documented in From Xenakis’s UPIC to Graphic Notation Today

(Weibel, Brümmer and Kanach 2020).

## UPIC Ludique

The UPIC Ludique focuses on both the tactile experience of drawing sound and the pedagogical aspects of UPIC, asking what the instrument might be like when reinvented as a child-friendly instrument. It is conceived as an avant-garde sound-making instrument that looks like a popular, well-built toy from the 1970s that never existed, think Etch-A-Sketch or Brio trains.

The core components of the instrument are a resistive touchscreen, eight pencils and pencil slots, with phototransistors used to detect when the pencils are lifted. In the second iteration, LED indicators were added to show when individual pencils, or combinations of pencils, are active. This was mainly to offer peace of mind that the device was running while using it.

UPIC Ludique, wood and electronics, Simon Blackmore, 2025

The screen and components are connected to a small Bela computer capable of running SuperCollider, C and Pure Data. A USB connector and 3.5 mm audio input, headphone and line outputs allow the instrument to operate as a battery-powered standalone unit, while also providing the possibility of sending OSC data over USB to external software and systems.

UPIC Ludique, wood and electronics, Simon Blackmore, 2025

## Limitations and Constraints

The original UPIC used an electromagnetic pen. During development, however, a resistive touchscreen and pencils seemed cheaper, more tactile and more accessible for the purposes of this toy-like instrument. The eight coloured pencils allow different parameters of a composition to be changed, either representing layers of sound or controlling different aspects of the composition. The original UPIC's ability to shift between working at the micro level of waveform shapes and the macro level of an entire composition makes it tempting to introduce additional buttons and controls, and even an external display, for saving waveforms and progressively building more complex compositions. However, this would run against the simplicity of the device and its toy-like appearance.

The current UPIC Ludique deliberately omits the Page and Sequence aspects of the original, shifting the focus from graphical composition to real-time performance. Rather than preparing a graphical composition and subsequently recording its performance, the act of drawing becomes the performance itself, with gestures directly generating and shaping sound.

This is a deliberate design constraint rather than simply a technical limitation. This aligns with Thor Magnusson's (2010) argument that constraints in digital musical systems can define a bounded space for musical expression, limiting complexity in ways that can encourage creative exploration. The UPIC Ludique similarly uses constraint to prioritise immediacy and accessibility, particularly in relation to its intended use with children.

## Usage and Reflection

Presentations of L'UPIC Ludique at galleries, open studios and NIME 2024 have demonstrated to me that the act of physically drawing on a surface to create soundscapes can be magical and mesmerising for users of all ages. This suggests a continued pedagogical and creative relevance in the tactile and playful qualities inherent in drawn-sound instruments. Revisiting this lineage shows how sonic thought can be shaped through gesture, friction, and the direct movement of the body, a form of embodied knowledge that the abstract logic of the Graphical User Interface (GUI) can often suppress.

## References

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