Sculptural storage format

1st Author Name Calin Segal

Abstract

In an era increasingly dominated by digital transience, the human yearning for permanence and certainty is disintegrating. What will remain of our time when our servers have stopped humming while the silicon on which we keep all our collective knowledge turns to dust? The paper addresses the tension between the transient state of digital storage and the human need for enduring legacies. This research explores how aesthetic elements like composition, scale, and proportions can transform into information carriers, effectively turning objects into Sculptural Storage Formats (SSF). SSF represents a unique fusion of art and information technology, where the physical form becomes a medium for storing and expressing quantifiable data and the qualitative dimensions of human existence. SSF reflects an experiment in merging the realms of abstract art with the precision of data and technology.

The study delves into the theoretical underpinnings of SSF, showcasing how this methodology reimagines the role of aesthetics in encoding and decoding information and briefly hints at its practical applications in bridging the gap between digital transience and enduring physical representation.

Keywords:

Sculptural Storage Formats (SSF), Digital Transience, Data Preservation, Art and Technology Integration, Aesthetic Data Encoding, Physical Data Repositories, Cultural Memory, Information Theory, Tangible Data Representation, Heritage and Digital Legacy.

I. Introduction

The practice of archiving information has been pivotal in shaping our cultural and civilizational progression, playing a fundamental role in our understanding of history and identity. Far from being a peripheral narrative, the evolution of information storage is a central thread woven through our collective existence, continually influencing and reshaping our journey toward the future. In our digital age, where information is as fleeting as it is abundant, have we lost our tangible connection to the data that shapes our lives? This question lies at the heart of an emerging dilemma: as we store our histories, cultures, and personal memories in the cloud, something integral seems to be slipping away.

Throughout history, the encoding and decoding of information have been closely linked to the tangible forms they inhabit. From the etchings on clay tablets to the meticulous ink on paper scrolls, each medium has preserved information and influenced its interpretation. In this era of digital ascendancy, our tools for data storage, while marked by extraordinary efficiency, are also characterized by an inevitable transience. Information, now dematerialized into bytes and bits, can be continuously updated, modified, or erased. This evolution of digital storage creates a sharp contrast with our intrinsic need for permanence and tactile connection, a yearning deeply rooted in our human experience.

Historical context is key to understanding this modern challenge. Pioneers like George David Birkhoff, Max Bense, and Abraham A. Moles laid the groundwork in information aesthetics, harmonizing data with aesthetic expression. Birkhoff's concept of quantifying aesthetic value, Bense's integration of aesthetics and artifacts in the 1950s and 1960s, and Moles' exploration of the interplay between information theory and aesthetic perception have profoundly influenced our understanding of data representation.

This paper introduces SSF, a contemporary approach that refrains our connection with data by transforming abstract digital information into meaningful, tangible artifacts. Drawing from the rich legacy of information aesthetics, SSF endeavors to bridge the gap between digital ephemerality and the enduring human need for tangible, resonant data representations.

II. Conceptual Framework

Drawing upon phenomenological principles, SSF seeks to materialize data in a manner that engages not just the visual senses but also invites tactile and spatial exploration. This approach aligns with Maurice Merleau-Ponty's views on the primacy of perception, where the physical form of the sculpture becomes a medium through which data can be experienced and understood in a more intuitive and embodied manner. In this sense, the object becomes a mnemonic device akin to the Luba Lukasa memory board. In traditional Luba culture, the memory board serves as a physical abstract storytelling device, where the placement and configuration of beads and carvings on the wooden board are used to recall narratives, genealogies, and historical events.

Similarly, the Quipu (Khipu) of the Inca civilization illustrates a sophisticated method of encoding information through physical means. In Quipu, information is not represented directly but is encoded through the spatial arrangement and distance of knotted cords and beads. This method goes beyond simple representation, utilizing a complex system of spatial relationships and tactile cues to store and convey information. The process involves transforming data into a series of spatial and physical variables, making the Quipu a powerful tool for memory and understanding.

The SSF objects, akin to the Quipu and Lukasa, transcend being passive recipients of inscribed data; they actively participate in the process of knowledge transmission and interpretation. Each sculpture's aesthetic elements - **its shape, texture, and spatial arrangement** - are a cue for the underlying information

III. Guiding Axioms

To ensure effective implementation and understanding of SSF, a set of guiding axioms is introduced. Firstly, they establish a clear and consistent framework, ensuring that each sculpture created under this method adheres to a unified set of principles.

This framework not only guarantees uniformity in the approach but also helps balance the aesthetic appeal with the informational content of each piece. By doing so, these axioms ensure that the sculptures are both visually engaging and meaningful as data repositories. Additionally, they emphasize viewer engagement and personal interpretation, transforming each sculpture into an interactive piece that invites exploration and reflection.

1. **Geometric Universality**
An SSF should anchor itself in geometric and mathematical processes independent of cultural biases.
2. **Intrinsic Encoding:**
Data must be encoded in the object's aesthetic properties when transposed in tangible forms.
3. **Data Integrity:**
The encoder must never alter but transform the data.
4. **Functional forms:**
The encoding process should harmonize the tension between readability and plasticity intention.
5. **Decoding:**
For every action the encoder takes, there must be an equal and corresponding counterpart in the decoder.

IV. Methodology

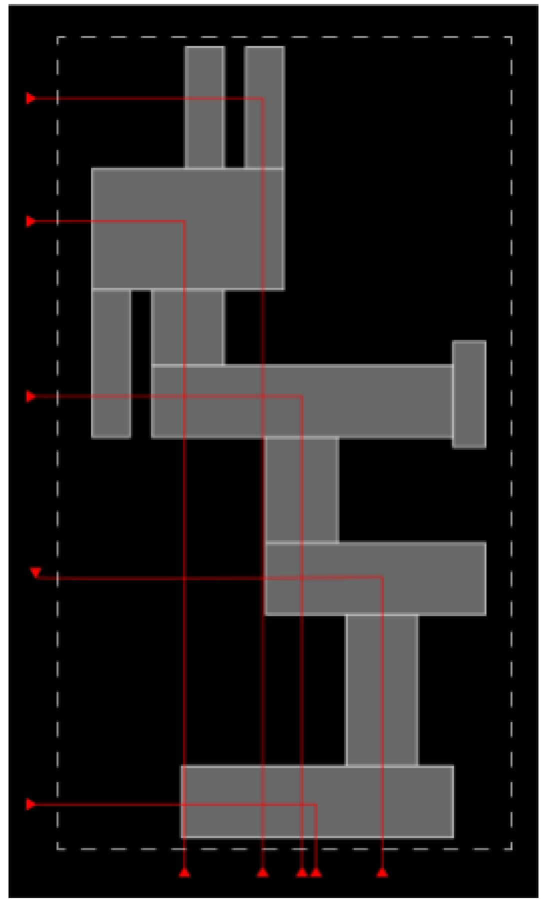
Sculptural Storage Formats refer to the technique of embedding information within the aesthetic features of an object. This method utilizes composition, scale, proportions, and materials as unique data holders. Unlike traditional data visualization forms, the information does not necessarily dictate the morphogenetic process; instead, the encoding models ensure the object's final plasticity.

In creating an SSF, encoding processes are employed for converting the data into visual patterns. The encoding process translates the input data into rules or instructions that determine how the sculpture will evolve and take shape. This process involves interpreting data as static values and directives that influence the sculpture's growth, form, and structure. The datasets are interpreted based on their numerical affirmation. When creating such a model, the process must allow for converting non-numerical values into numerical values. Text and images must be redefined based on a look-up table, such as ASCII characters or RGB values.

Based on my current test cases, I identified a series of unifying principles that define the encoding process. Each category is defined by how the data is transformed into spatial configurations:

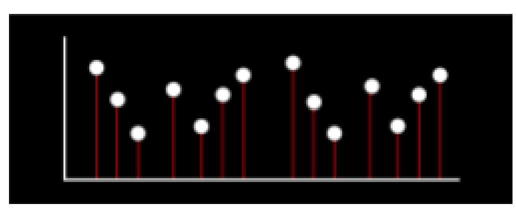
A. Special Disposition
B. Topology Distortion
C. Multi-dimensional Lexicon

A- Spatial Disposition



Definition and Role: The Spatial Disposition category of the SSF encoding process focuses on translating data into distinct spatial arrangements within the sculpture, emphasizing three key patterns: **clustering, fragmentation, and dispersion**.

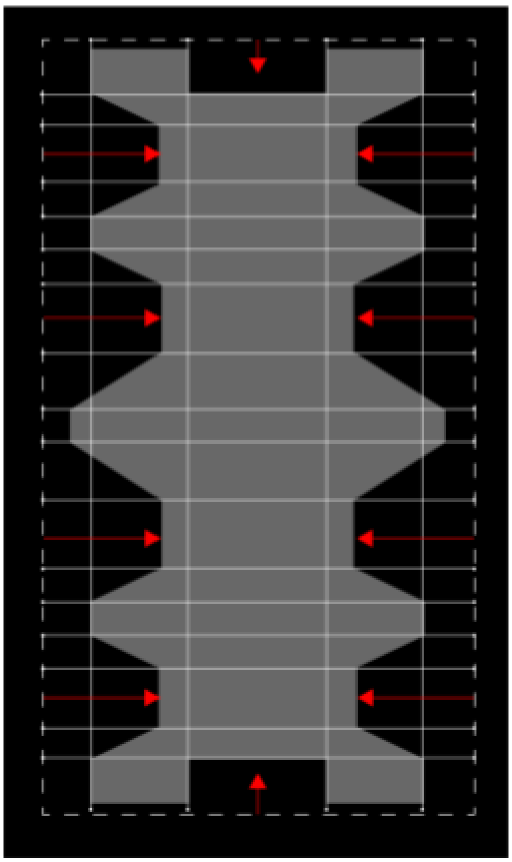
Encoding: The datasets are interpreted based on their numerical affirmation. In this case, the spatial relationship between each element can provide information on how



different data sets or subsets have been converted. This will be used for decoding the information.

Decodability: The decoding of Spatial Disposition in SSF is contingent upon a predetermined set of interpretive rules and guides. For instance, the proximity of elements within a sculpture may represent the relational dynamics of data sets, whereas the scale of components correlates to the magnitude of numerical values. This systematic approach ensures that each spatial configuration, though artistically rendered, adheres to a structured, interpretable code, facilitating the retrieval of encoded data.

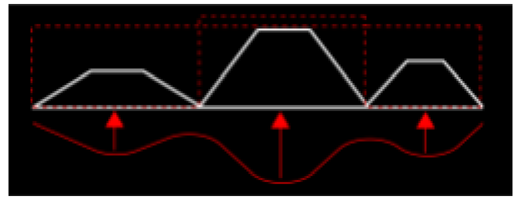
B - Topology Distortion



Definition and Role: In the context of Sculptural Storage Formats, 'Topology Distortion' refers to deliberately altering the object's shape and features to embody specific patterns and characteristics of the underlying data.

Encoding: The process begins by mapping data onto the topological features of Euclidean geometry e.g., monoliths and columns. For example, certain data points or values might correspond to variations in curvature, undulations, or even disruptions of the original form.

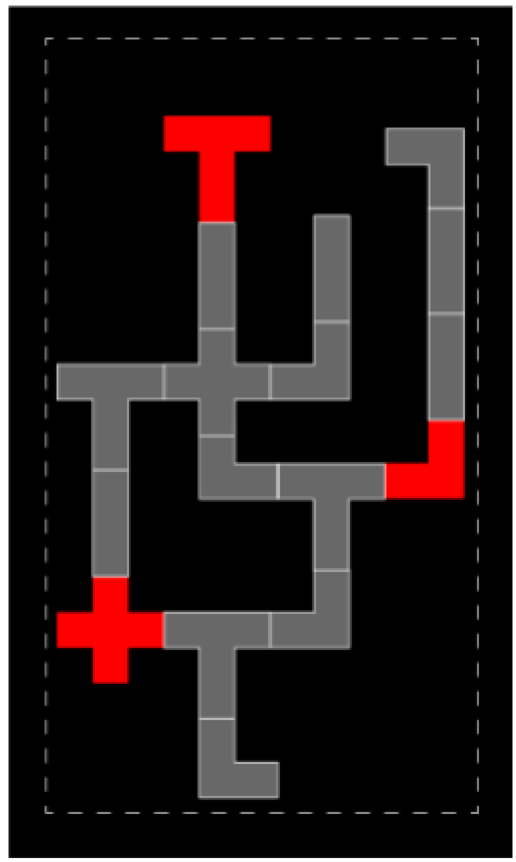
Decodability: A critical aspect of this approach is maintaining the integrity and decodability of the encoded data. Each topological modification must be precise and interpretable. Also, the original geometry must be known



to ensure that the data can be accurately reconstructed from the sculpture's form.

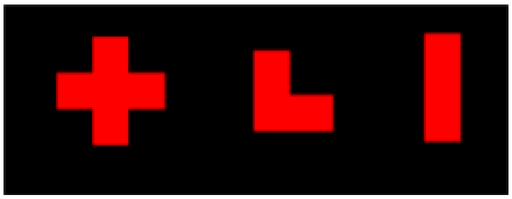
C - Multi-dimensional Lexicon

Definition and Role: The 3D Dictionary of Symbols in the



context of SSF functions as a codex or lookup table, where specific three-dimensional forms are predetermined to represent distinct numerical values or data elements. This system is akin to a visual language, where each form is a 'word' with a fixed meaning, directly correlating to a piece of data.

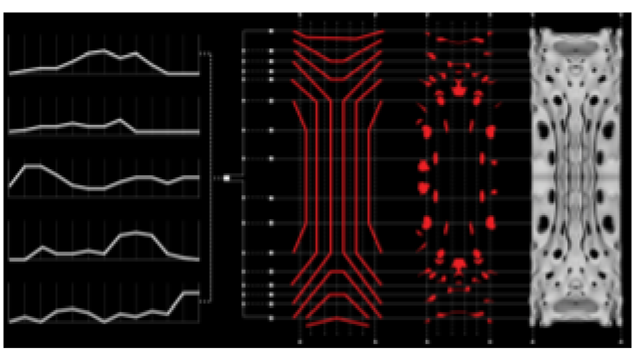
Encoding: The process starts with defining a set of symbols that represent the numerical values. The next stage is setting a Grammatical system of rules and structures that govern how these symbols are organized and combined, the focus is on syntax and semantics. Here, the spatial arrangement of the predefined shapes starts to define the morphogenetic process.



Decodability: To decode a sculpture encoded using the Sculptural Data Lexicon (SDL), access to the original lexicon and its grammatical system is essential. This process requires a thorough understanding of the specific three-dimensional forms designated for each data element and their corresponding attributes, as the lexicon outlines. The decoder must be adept at identifying and interpreting these forms, considering their size, orientation, texture, and spatial arrangement concerning the established rules of the SDL

V. Measuring the intrinsic value

To comprehensively understand the Sculptural Storage Formats (SSF) concept, a mathematical model has been developed that delineates the balance between aesthetic value and data integrity. This model is designed to evaluate the aesthetic significance and encoding efficacy of an SSF system, thereby highlighting the subtle equilibrium that



must be navigated between form and function. The Aesthetic Efficacy Metric is central to this evaluation and is formulated as follows:

$$E = (C * N) / D$$

E (Aesthetic Efficacy): This represents the sculpture's effectiveness in merging its visual appeal with its functionality as a data storage medium. A low value of E could indicate limited data diversity or substantial complexity in decoding.

C (Compositional Structure): It encompasses the geometric alignment, symmetry, or asymmetry, the interplay of volumes and voids, and the distribution of mass within the sculpture.

N (Numerical Complexity): Denotes the richness of the data encoded. More complex data can result in intricate patterns, varied textures, or other distinct features in the sculpture.
D (Decoding Accuracy): Measures the difficulty in retrieving the original data from the SSF object. A lower D value, indicating ease of decoding, enhances the overall aesthetic efficacy.

For an SSF object to fulfill its intended purpose, its aesthetic value, indicated by $C \times N$, must be integrally linked to its visual and tactile elements. Concurrently, the object's overall value is influenced by the ease of the decoding process, as represented by D. If the decoding process is excessively complex, the sculpture, regardless of its visual allure, risks being diminished in value as a storage format, reducing it to merely an ornamental artifact and obscuring its inherent storage functionality.

The equation assumes that the overall aesthetic efficacy (E) is directly influenced by the compositional structure (C) and the numerical complexity (N), while also factoring in the impact of decoding accuracy (D). This approach is inspired by George David Birkhoff's work on aesthetics, particularly his concept of the "aesthetic measure" applied to art and design. Birkhoff's formula, which defines aesthetic value through the ratio of Complexity to Order, is adapted here. In our context, 'Complexity' is derived from the product of compositional structure and the numerical complexity of the data. At the same time, 'Order' is analogous to decoding accuracy, relating the aesthetic value to the functional aspect of data storage.

Furthermore, the application of this model extends beyond mere theoretical analysis, offering practical insights into the design and evaluation of SSF objects. By quantitatively assessing the balance between aesthetics and functionality, creators of SSF can make informed decisions about the composition and complexity of their sculptures.

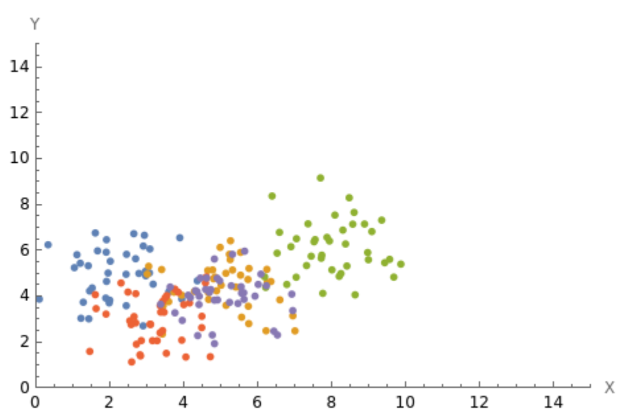
The efficacy of an SSF object, therefore, extends beyond its physical composition and data complexity to include the user's experiential journey through discovery, interpretation, and understanding. This holistic approach, rooted in a synthesis of aesthetics, data representation, and user experience, embodies a comprehensive model for SSF design and evaluation.

VI. Examples

To showcase the implementation of SSF, I selected three projects I have developed from 2022 to 2023.

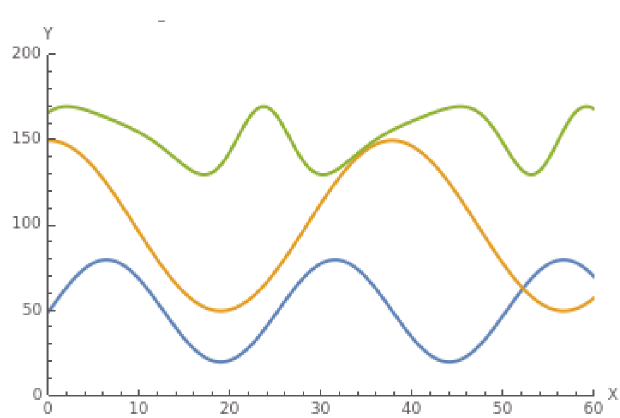
Case 1: *Erebus Tower* 2020 - Bronze Polish 3D printed
Type: Special Disposition
Benefactor: Anonymous Corporate
Data type: sales figure - private

Data set:

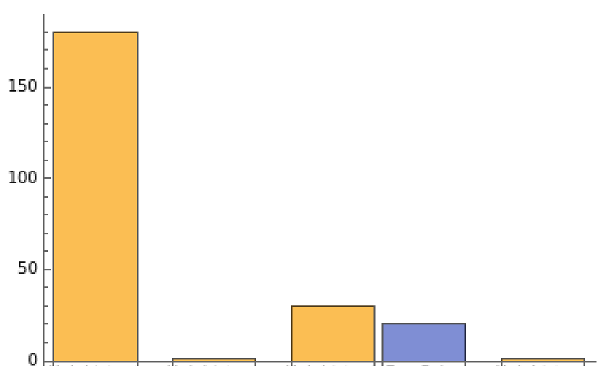


Case 2: *Urban Echos* - 2023 - Laser Cut cardboard
Type: Topology Displacement
Benefactor: City of Nicosia Cyprus
Data Type: Urban data from Smart Nicosia project

Data set :
green = cars
blue = pedestrians
yellow = bikes



Case 3: *Urban Echos* - 2023 - Bronze Unpolish 3D printed
Type: Multi-dimensional Lexicon
Benefactor: Private Client
Data Type: Biometric data



Column A = Person A Height
Column B = Face height
Column C = Angle between aye nose and chin
Column D = Fingerprint hex code
Column E = Face width

VIII. Conclusion

This research introduces Sculptural Storage Formats (SSF) as an innovative approach to data preservation, merging art with information technology. By embedding data within the aesthetic elements of sculptures, SSF offers a tangible and enduring alternative to the transient nature of digital storage. The study provides a theoretical and practical framework for SSF, informed by historical examples and phenomenological principles.

Looking ahead, current research is expanding into new SSF domains. Efforts are underway to explore novel encoding forms, mainly using field equations to convert data, which may offer more nuanced and complex data integration methods within sculptures. Additionally, there is a growing interest in the potential of 2D abstract compositions as a new avenue for SSF. This exploration into two-dimensional formats could broaden the applicability and accessibility of SSF, allowing for diverse and versatile representations of data.

These future directions promise to enhance the scope and efficacy of SSF. As this research progresses, it aims to bridge further the gap between digital ephemerality and the human desire for tangible, lasting data representation, opening new possibilities for preserving and interacting with our digital legacy.

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