The Evolution Narrative of Architectural Form and The State of *Vital Form*

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The concept of *form* in architectural design has been debated since prehistoric times. In its most straightforward meaning, *form* can be defined as the shape, shell, and inhabited volume of a structure. This study aims to explore the historical process of the transformation and evolution of form, as well as to discover new meanings and potentials of form through analysis, and to develop a critical perspective on form. The study is structured around three main axes. In the first stage, a mapping is designed to analyze the evolution of form throughout history. This mapping focuses on the changes in the approach to form, design, and making techniques chronologically. This stage reveals that form is no longer merely a final product represented by drawings or statically produced, but rather a concept that involves process and dynamism in a temporal-spatial dimension, whether in its design or production. In the second stage, the evolution of form is discussed through a new concept called '*vital form*'. In the comparison between *form* and *vital form*, while *form* represents something static or stationary, *vital form* signifies a dynamic and fluid state. While *form* describes a state that is symbolically designed with analogue drawing or produced by the designer from top to bottom, *vital form* represents a bottom-up, autonomous state formed by the influence of actors involved in design or production. Subsequently, the relationships, transitions, interactions, and changes between *form* and *vital form*, as well as their interpretations, are discussed within the proposed model in the study, based on conceptual sets derived from theoretical debates and the implications in design and making processes. It is believed that such exploration and awareness of form in architecture will bring new dimensions to the contemporary understanding, design, and making practices of form.

Keywords: Architectural Form, Form, Form Design, Form Making/ Production, Vital Form.

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Mimari Formun Evrim Anlatısı ve *Canlı Form* Hali

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Mimarlık tasarımında *form* kavramı, tarih öncesi dönemlerden beri tartışılmaktadır. En yalın haliyle, *form*, yapının şekli, kabuğu, içinde yaşanan hacim olarak ifade edilebilir. Çalışmada hedeflenen, tarihsel süreçteki formun değişimini ve evrimini analiz ederek yeni anlamlarını ve potansiyellerini keşfedebilmek ve form üzerine eleştirel bir bakış açısı geliştirebilmektir. Bu hedef doğrultusunda çalışma üç ana eksen üzerinde kurgulanmıştır. İlk aşamada, tarihsel süreçte formun evrimini analiz etmek için tasarlanmış bir haritalama yer almaktadır. Bu haritalama ile kronolojik olarak, formun ele alınış biçimindeki değişimler, form tasarım ve üretim tekniklerine odaklanılarak tartışılmaktadır. Bu aşama ile, formun artık sadece çizimlerle temsil edilen ya da statik olarak üretilen nihai bir ürün olmadığı, aksine zaman-mekânsal bir düzlemde, tasarımında ya da üretiminde süreç ve dinamizm içeren bir kavram olduğu anlaşılmaktadır. İkinci aşamada ise, formun evrimi 'canlı form' (vital form) olarak ifade edilen yeni bir kavram üzerinden tartışılmaktadır. *Form* ve *canlı form* karşılaştırmasında, *form*, statik veya durağanı temsil ederken, *canlı form*, dinamik ve devingen bir hal tarif etmektedir. *Form*, tasarımcı tarafından çizim ile sembolik olarak tasarlanan veya yukarıdan aşağıya oluşturulan bir hal ifade ederken, *canlı form*, tasarım veya üretimine etkide bulunan aktörlerin etkisiyle aşağıdan yukarıya oluşan, otonom olan bir hal ifade etmektedir. Ardından, çalışma kapsamında önerilen model üzerinde, *form* ve *canlı form* arasındaki ilişkiler, geçişler, etkileşimler, değişimler; kuramsal tartışmalardan elde edilen kavram setleri ve üretim, tasarım süreçlerindeki açılımları birlikte ele alınmakta ve yorumlanmaktadır. Mimarlıkta forma ilişkin böyle bir okumanın, farkındalığın, günümüz form kavrayışına, tasarlama ve üretme pratiklerine yeni açılımlar getireceğine inanılmaktadır.

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1. INTRODUCTION

The concept of form in architecture has been evolving and transforming with new meanings since the early debates in the field. The aim of this study can be described as investigating the approach to form throughout its historical process and exploring its potential avenues. This purpose and exploration are rooted in *critical theory* which seeks to examine the logic and foundations of events and ideas, aiming to ask questions rather than provide answers (Raymond, 1981; Rendell, 2008). The goal is to develop a critical perspective on form within this context.

In the study, research on the form is conducted through the lens of *form design* and the *making* processes. This is because it is believed that changes in the conceptual understanding of *form* shape its *design* and *making* practices, and similarly, *form design* and *making* processes also transform *form*. This dual relationship can be examined through the *Sapir-Whorf hypothesis* (Terzidis, 2005; Kay & Kempton, 1984).

Exploring the form concept can be beneficial in defining the scope and limitations of the article:

"Form in everything and anything, everywhere and at every instant. According to their nature, and their function, some forms are definite, some indefinite; some are nebulous, others concrete and sharp; some symmetrical, others purely rhythmical. Some are abstract, others material. Some appeal to the eye, some to the ear, some to the touch, some to the sense of smell… But all, without fail, stand for relationships between the immaterial and the material, between the subjective and the objective -between the infinite spirit and the finite mind…" (Sullivan, 1947).

To understand the concept of form, it can be examined Sullivan's (1947) descriptions using abstract and material planes to express, and Forty's (2004) definition as the representation of massed solidity or the void in its negation or the representation of space. Alternatively, another approach to consider is the description of architectural design as the act of giving form to three-dimensional objects to serve as an external

shell and create an inhabitable space within. In this perspective, form is expressed as a boundary that defines the structure and space (Williams, 2022).

Considering such discussions, in the study, *form* can be defined as a shell that constructs space or a building envelope that physically encloses the void. And *form design* and form making/ producing refer to the tools, processes, methods, and practices through which the designer's idea of form is transformed into a design product, where the idea is materialized as physical or digital through techniques such as drawing, modeling, and fabrication.
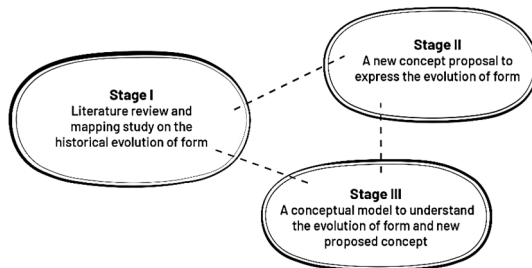
The study is structured around three main axes in order to bring a critical perspective on form **(Figure 1)**. The first stage involves a mapping where information is gathered through literature research. It focuses on the changes in the approach to *form, design, and making* techniques in the historical process. In the second stage, a new concept called *vital form* is proposed to express the transformation and evolution of form. In the last part, there is a conceptual model that aims to comprehend *vital form* concept through a comparison with *form*.

2. THE EVOLUTION NARRATIVE OF *FORM*

A mapping is carried out within the scope of the study to examine the changes in form throughout the historical process in relation to events, phenomena, theories, approaches. It has been constructed in chronological order, based on main headings, to highlight the paradigm shifts where form undergoes fundamental changes in meaning and acquires new significances. The narrative can be followed on the mapping in **Figure 2** which created by the four main headings as *The*

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Origin of Form[1], Form in the Analog Era, Form in the Digital Era, and *Form in the Millennium.*

The first one, *The Origin of Form* **(Figure 2)***,* which corresponds to the period from ancient times to the beginning of the 20th century, focuses on establishing a common understanding of form and exploring its origins, and initial approaches**.**

The narrative begins with the dialectic between Plato and Aristotle. Plato explains the universe using the symbolic and solid geometries called *Five Platonic Solids* (Plato, 4th century BC/2022; Forty, 2004; Dehovitz, 2016). On the other hand, Aristotle, presents the theory of *hylomorphism*, stating that form is shaped by matter, and they both arise from their inherent carriers (Aristotle, 4th century BC/2019; 4th century BC/2020; Forty, 2004). While Plato's form is static and represents fixed geometries in a top-down system, Aristotle's form is dynamic and emerges from generative minds in a bottom-up approach. This dialectic between representation and generative one provides a foundation of the study.
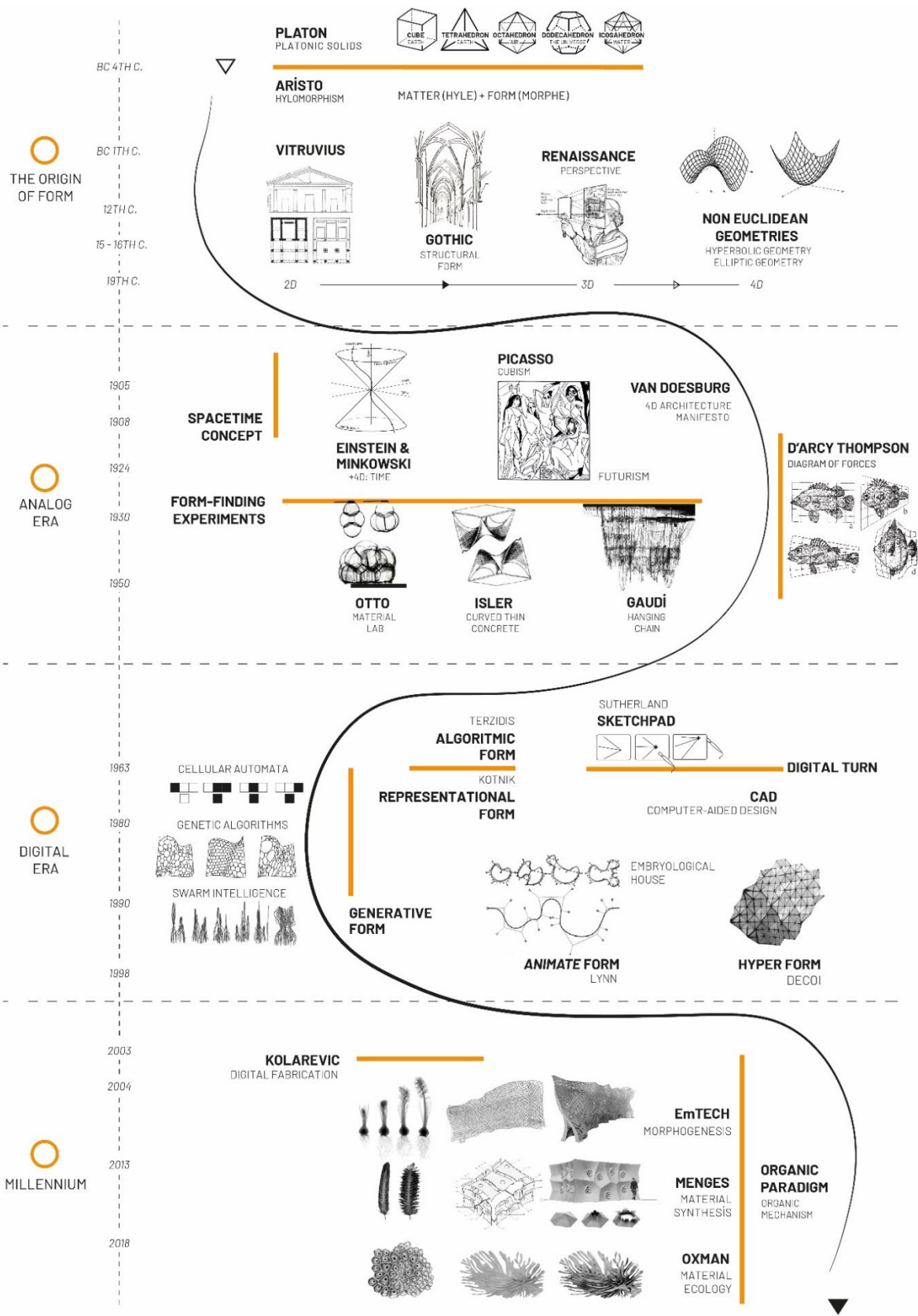
After this dualism, understanding Vitruvius would be helpful to analyzing form concept in ancient architecture.

Figure 2 (next page):
The mapping designed to follow the evolution narrative of form, adapted from (Author, 2023).

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[1] The title is derived from Darwin's (1859/2012) book "The Origin of Species," where he explains the theory of *evolution*.

THE ORIGIN OF FORM

BC 4TH C.

PLATON
PLATONIC SOLIDS

CUBE EARTH | TETRAHEDRON EARTH | OCTAHEDRON AIR | DODECAHEDRON THE UNIVERSE | ICOSAHEDRON WATER

ARİSTO
HYLOMORPHISM

MATTER (HYLE) + FORM (MORPHE)

BC 1TH C.

VITRUVIUS

RENAISSANCE
PERSPECTIVE

12TH C.

15 – 18TH C.

GOTHIC
STRUCTURAL FORM

NON EUCLIDEAN GEOMETRIES
HYPERBOLIC GEOMETRY
ELLIPTIC GEOMETRY

19TH C.

2D → 3D → 4D

ANALOG ERA

1905

SPACETIME CONCEPT

1908

PICASSO
CUBISM

VAN DOESBURG
4D ARCHITECTURE MANIFESTO

1924

EINSTEIN & MINKOWSKI
+4D: TIME

D'ARCY THOMPSON
DIAGRAM OF FORCES

FORM-FINDING EXPERIMENTS

1930

FUTURISM

1950

OTTO
MATERIAL LAB

ISLER
CURVED THIN CONCRETE

GAUDİ
HANGING CHAIN

DIGITAL ERA

1963

CELLULAR AUTOMATA

TERZIDIS
ALGORITMIC FORM

SUTHERLAND
SKETCHPAD

1980

GENETIC ALGORITHMS

KOTNIK
REPRESENTATIONAL FORM

DIGITAL TURN

CAD
COMPUTER-AIDED DESIGN

1990

SWARM INTELLIGENCE

GENERATIVE FORM

EMBRYOLOGICAL HOUSE

1998

ANIMATE FORM
LYNN

HYPER FORM
DECOI

MILLENNIUM

2003

KOLAREVIC
DIGITAL FABRICATION

2004

EmTECH
MORPHOGENESIS

2013

MENGES
MATERIAL SYNTHESİS

ORGANIC PARADIGM
ORGANIC MECHANISM

2018

OXMAN
MATERIAL ECOLOGY

Vitruvius formulates form by establishing specific parameters and verbal equations among various elements such as plan size, column height, column thickness, and intercolumnar spacing (Vitruvius, 1st century BC/1990). Design relies on parameters, but form is generated using specific, fixed geometries and drawing-based techniques. This approach implies that form in ancient examples is visually represented.

Figure 3: Different rib vault structures (Siegel, 1962).

In the Gothic period, it can be observed that form acquires another meaning in conjunction with *structural form*. *Structural form* is an approach where form and the structural system are designed and calculated together (Siegel, 1962). **Figure 3** illustrates three examples of rib vault structures. The first example, which is an extension of the structural system, is referred to as a *structural form*. The other two examples are considered *decorative forms* since they lack structural considerations. (Siegel, 1962). Form in conjunction with *structural form* is designed and produced to serve a kind of performance for the structure beyond being representational with simple geometries.

When examining the Renaissance period, a significant change can be observed in the difference between *form design and making*. The discovery of perspective and new three-dimensional drawing techniques provided architects with a new avenue to convey their designs to those responsible for the making process, even without being present at the construction site (Roth, 1993). This development led to the widespread use of drawing as a method for form design, which continued for a considerable period after the Renaissance (Menges, 2015).

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These new drawing techniques are examined under the title of *Euclidean geometries* and new quests' existence in the 19th century are expressed that surpass these *dead geometries* (Evans, 1995). The fundamental change at this point can be considered as overcoming planarity and parallelism, which can be examined under the title of *non-Euclidean geometries* like *hyperbolic* and *elliptic geometries* (**Figure 4**) (Henderson, 1983; Faculdade De Ciências Universidade De Lisboa, 2017). *Euclidean geometry* and solid Platonic shapes, which have been used in architecture since ancient times, are being surpassed, and new forms are emerging, that go beyond the concept of three dimension. These searches also lay the groundwork for the concept of *space-time*, which will be detailed in the next part of the narrative (Giedion, 1941; Frampton, 1995; Kolarevic, 2003).
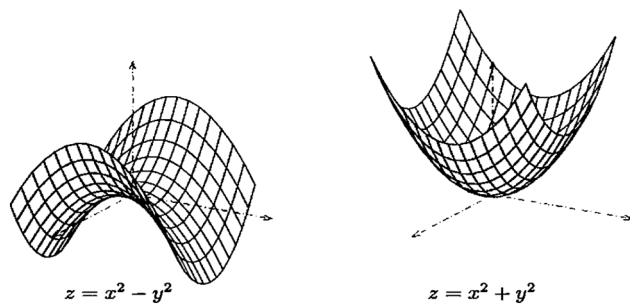
$$z = x^2 - y^2 \qquad z = x^2 + y^2$$

Figure 4: *Hyperbolic* and *elliptic geometries,* adapted from (Wikipedia, 2015).

Under the second heading, *The Form in the Analog Area* (**Figure 2**), which corresponds to the first half of the twentieth century, the effects of the paradigm shift caused by the concept of *space-time* on form are examined. Giedion (1941) describes this change as a new era where the static is demolished, and the dynamic is sought.

In the initial stage, it can be useful to examine the early periods of this concept. Einstein articulates the concept of *space-time* in his *Theory of Relativity* (Miller, 2001). The inclusion of time (t) as the fourth dimension, in addition to the three spatial ones (x, y, z), indicates that the discussion is not only about spatial but also about spatiotemporal dimension (Bakırcı et al., 2022). On the other hand, Picasso, regarded as the beginning of *Cubism*, also demonstrates the discussion of space-time with 'The Young Ladies of Avignon' (Giedion, 1941; Miller, 2001). He surpasses the three-dimensional perspective by incorporating the simultaneous and relative representation of various time frames

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(**Figure 5**) (Miller, 2001). Later, *Futurist* artist explored this concept as a representation of movement and dynamism in art (**Figure 6**) (Giedion, 1941). In the same periods Doesburg (1924) published his manifesto which calls for four-dimensional *space-time* aspects in architecture shaped by *non-Euclidean mathematics.* It signifies the beginning of a new era in the architectural form (Burry, 2016).


Figure 5: The Young Ladies of Avignon, adapted from (WikiArt, 2020).

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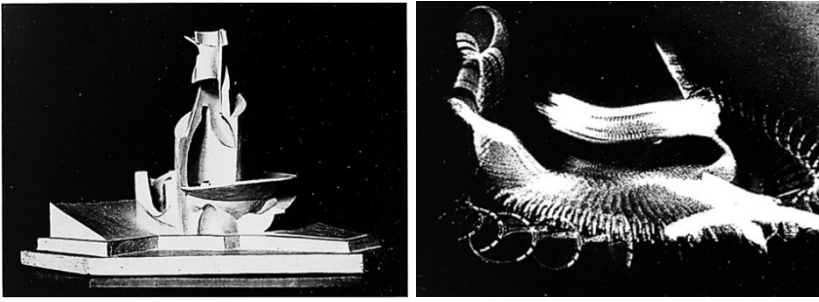
Figure 6: Boccioni's development of bottle in space (left), Edgerton's high-speed photography (right), (Giedion, 1941)

To further explore the topic, it may be useful to examine Thompson's (1917/1945) form analysis with the *diagrams of forces*. He focuses on the formation of form under the influence of physical forces and explores transformations of different species' forms (**Figure 7**). This approach emphasizes form's ability to evolve, grow, develop, and change over time through a continuous process.
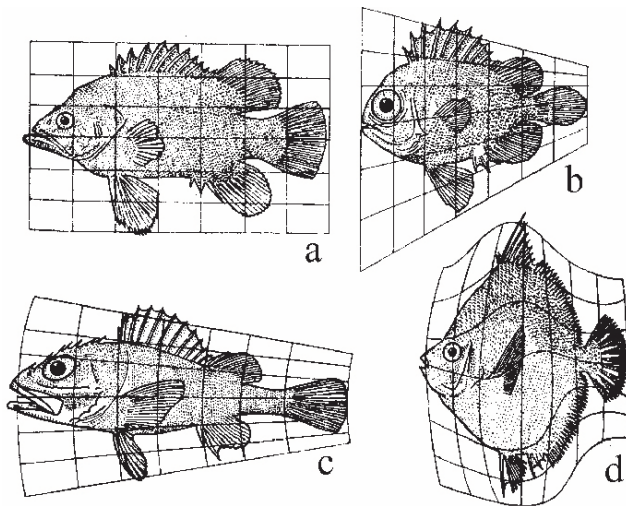
Figure 7: Thompson's (1917/1945) form analyses.

Thompson's studies contribute to the concept of *form-finding* being discussed in the ongoing narrative (Goldsmith, 2014). *Form-finding* can be described as a method where the form is designed, calculated, and optimized in accordance with the forces that shape it (Lewis, 2003). With this technique, form transcends its static state as a two-dimensional or three-dimensional product drawn on paper or created in physical models, and it becomes a process-driven entity existing in four dimensions under the influence of environmental forces. For example, Antonio Gaudi, designed his projects through dynamic *models* and experiments based on *material computation* (Burry & Burry, 2010;

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Claypool, 2017). He created various *analog models* where forms were shaped and structurally optimized under the influence of gravity by *hanging chains* and *sandbags* (**Figure 8**).
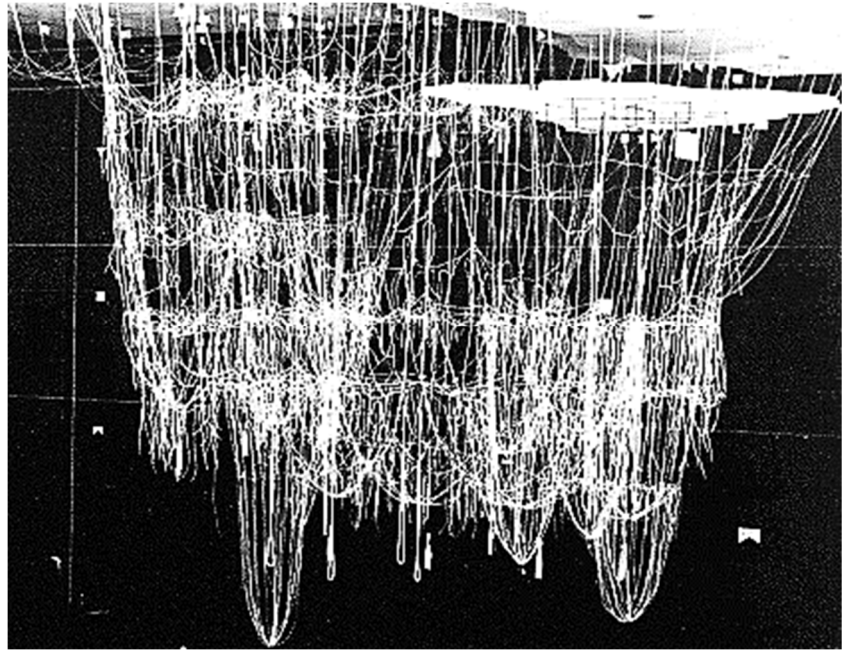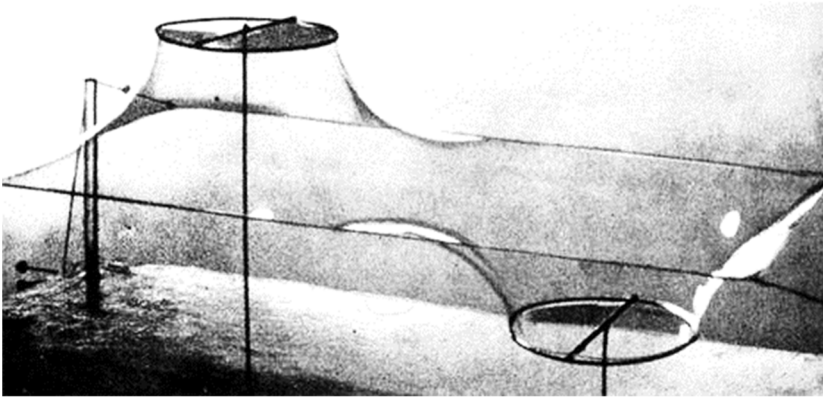

**Figure 8:** Gaudi, *hanging chain* model (Burry et al., 2005).

Similarly, Heinz Isler focused on thin, curved concrete shell forms that achieved high strength while utilizing minimum material (Chilton & Isler, 2000; Kloft, 2011). He describes his design process not as 'creating form' but rather as 'allowing the form to emerge according to its own internal dynamics' (Billington, 2003). In another example, Frei Otto, created an extensive material laboratory for *form-finding* experiments (Otto & Rach, 1995). In this laboratory, he conducted various experiments including *soap film experiments* based on the principle of minimum surface area (**Figure 9**), *pneumatic models*, *plaster bandage models*, *hanging chain networks*, sand pile models, and *thread models* (Drew, 1976; Otto & Rach, 1995; Frei Otto Film, 2017). In Otto's experiments, it is observed that after achieving the internal balance and optimization of the form, digital systems are employed to test and improve the structure (Glaeser, 1972; Boller & Schwartz, 2020). These processes can be considered as a precursor to the transition from the analog era, which is being examined in this heading, to the digital era.

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In the third heading, *Form in the Digital Era* (**Figure 2**), which pertains to the latter half of the 20th century, the effects of the *digital turn* (Carpo, 2013) are examined in relation to form. This paradigm shift occurred with the integration of computer technologies and *computation* into the design process.

With the recognition of computer-aided design (CAD) in 1960 (Llach, 2015), new kind of tools emerged in the design process. Ivan Sutherland's *Sketchpad* is considered the first design tool that allows drawing on a computer screen with a *light pen* and incorporates parametric relationships (AA School Of Architecture, 2010; Tedeschi, 2014). With Sketchpad, it can be observed that the static and immutable straight lines previously used in form design are evolving into dynamic lines that consider parametric relationships (**Figure 10**).
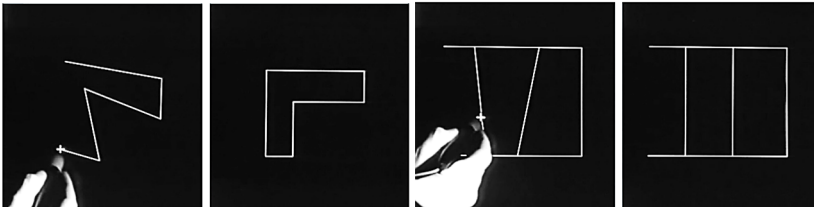

Figure 10: Drawing at Sketchpad (Morphocode, 2020).

Due to significant later developments such as the emergence of AutoCAD in the 1980s, architects were able to create two-dimensional drawings digitally, replacing traditional pen and paper with the use of a mouse and computer screen (Tedeschi, 2014). Similar to the discovery of *perspective* at Renaissance*,* the shift from two dimensions to three dimensions in the digital realm can be examined through software such as CATIA, which enables three-dimensional modeling (Team D3, 2016).

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CATIA and AutoCAD, unlike Sketchpad, are considered static drawing tools due to their lack of parametric relationships. This limits designers' control over lines on the screen and restricts their freedom in the digital environment during this period (Terzidis, 2005). The suggested solution is the use of *algorithms* that allow direct intervention on the digital screen through *scripting* instead of predefined buttons with fixed functions (Tedeschi, 2014). *Algorithms* are defined as a process with a finite number of steps. The era of designing forms with a pen or mouse is being replaced by designing forms with codes and words (Tedeschi, 2014).

Terzidis (2005) discusses the shift from representing forms through three-dimensional solid modeling tools to designing the process of formation through planned steps in *algorithmic form* generation. To understand this shift, Kotnik's (2010) conceptual model can be examined which classified design programs under three main categories: *representational, parametric,* and *algorithmic*. The transition from a model where geometry of form is directly represented to a model where the functional definition of form is designed signifies the overcoming of the *digital threshold* between these categories (Kotnik, 2010).
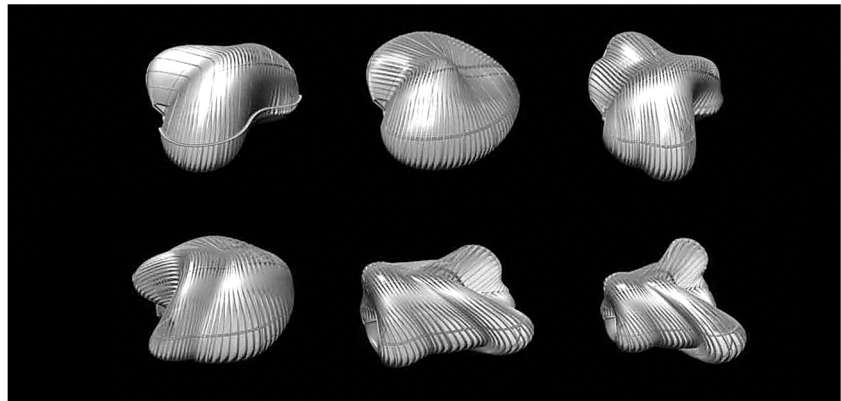
During this period, it seems that another design approach is discussed on literature as *generative design*. It disrupts predictable form-representation relationships by utilizing computationally generated complexities, providing new design possibilities (Agkathidis, 2015; Singh & Gu, 2012; Abrishami et al., 2014; Çağdaş, 2021). Form goes beyond geometric models and gains a generative meaning by autonomously reproducing itself through rule sets, even exhibiting self-design capabilities (**Figure 11**).

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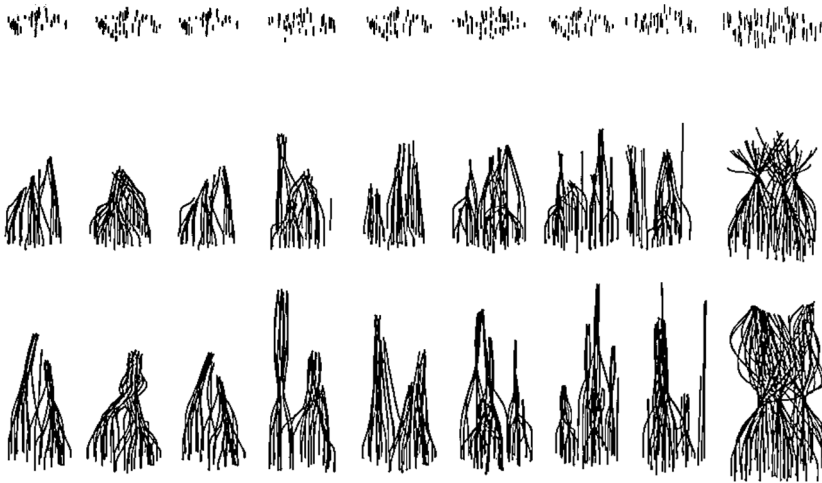
Figure 11: Form generation by agent-based modelling, adapted from (Chen, 2016).

To understand the impact of the *digital turn* on architectural form, it is beneficial to examine its manifestations in the field of architecture. Lynn (2005) suggests that designers no longer rely on simple geometric patterns like squares, circles, and rectangles as a starting point. Instead, with the aid of computer technologies, form has evolved into a fluid, dynamic, continuous state as described by Lynn's *animate form* (Lynn, 1999). The 'Embryological House' project, depicted in **Figure 12,** exemplifies this principle with its various variations (Lynn & Rappolt, 2008).

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Figure 12: Embryological House project, adapted from (SFMOMA, 2002).

In dynamic form designs based on curvature, various drawing tools such as *splines* that utilize *control points* are employed (CCAchannel, 2012). Notably, there is a resemblance between Lynn's curves shaped through *control points* and Gaudi's *hanging chain* model mechanism, as depicted in **Figure 13**. This similarity holds the potential to bridge discussions conducted in both the analog and digital eras, leading to a shared understanding.

Figure 13: (left) Lynn's (1999) s*plines*, (right) Gaudi's hanging model (Lazaro, 2017).
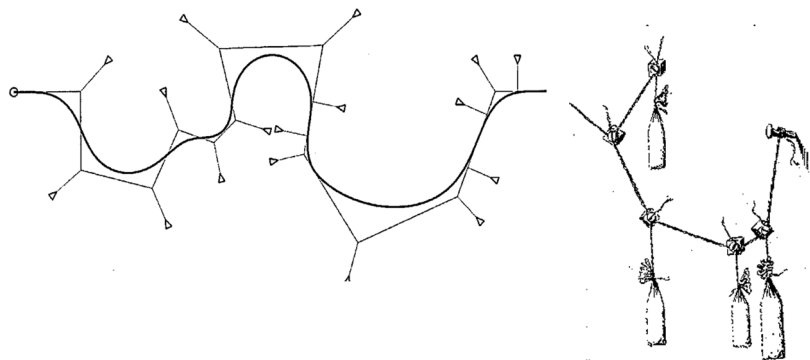
Examining the works of dECOi, during a similar period to Lynn, can contribute to the integration of different approaches. Mark Goulthorpe, the founder of dECOi, introduces the concept of *alloplastic* to describe their design approach, which emphasizes processes that evolve interactively in relation to the environment (Goulthorpe, 2009; Burry, 2012). For instance, the 'Aegis Hyposurface' project represents a four-dimensional animated wall that continuously interacts with light, sound, and motion in the physical environment (**Figure 14**) (Burry & Burry, 2010; Burry, 2011). Through dECOi, a new *hyper-form* approach

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emerges, capable of being shaped by environmental forces in real-time within the physical environment (Goulthorpe, 2009).

Lynn emphasizes the difference between his pursuit of *animate form* the digital realm and Goulthorpe's exploration of *hyper-form* that extends into the physical environment (Melbourne School of Design, 2017). This distinction leads to the next heading, where form is designed and created collaboratively in both the digital and physical realms, merging the narrative of form evolution.

The last title, *Form in the Millenium* (**Figure 2**)*,* encompasses the first quarter of the twenty-first century, the effects of the paradigm shift resulting from the development of fabrication technologies (Oxman, 2009; Demir, 2020) are explored in relation to form.

Kolarevic (2003) emphasizes the reduction of distance between design and production through the direct transfer of design information in the fabrication equipment (Scheurer et al., 2005; Bayram et al., 2023). To understand the design approaches of this era, it is helpful to consider the emerging *organic paradigm*. Giedion (1948) suggests that new theorems in physics are leading to a transition from the mechanical realm to the organic one, as described by Whitehead's (1920/2017) *organic mechanism* approach (Giedion, 1948; Molella, 2002). Oxman (2015) also highlights this shift from *the age of the machine* to *the age of life*. These concepts have become more evident in practice due to

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advancements in production technologies and the emergence of new design approaches in the 21st century.

To understand the impact of this transformation on form, it is of value to examine the pioneering figures of the era. EmTech, for instance, approaches form through *morphogenesis*, viewing it as a dynamic entity that can grow, evolve, and adapt (Hensel et al., 2004). Their design approaches are not defined by traditional categories such as *form*, *material*, or *structure*, but rather by a *holistic model* that emerges from their combination. The 'Honeycomb' project is an example where form, material, and structure are explored through genetic algorithms, shaping a honeycomb in the digital, and produced at 1:1 scale in the physical realm (**Figure 15**) (Hensel et al., 2010).
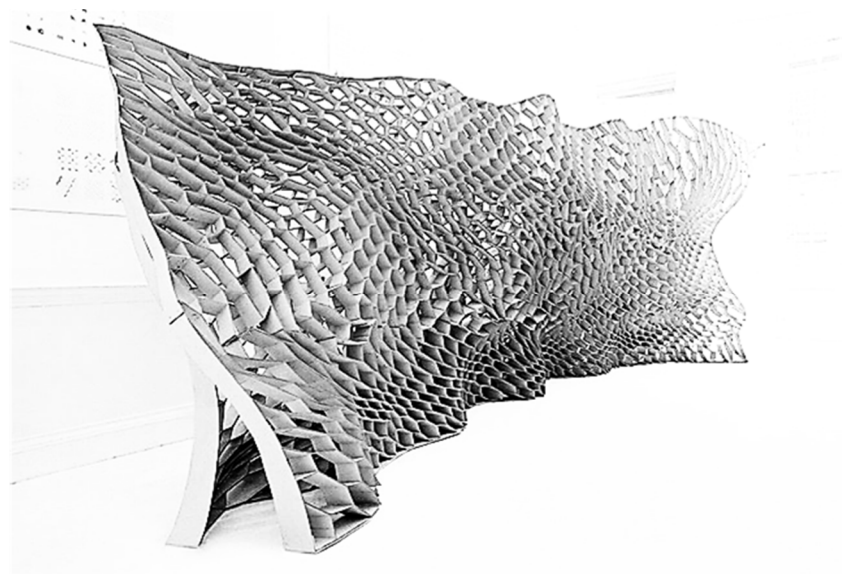
**Figure 15:** Honeycomb project, (Kudless, n.d.).

In another example, Achim Menges (2012) criticizes the previous era's tendency to produce form exclusively in the digital realm, detached from materiality. He proposes an approach called *material synthesis*, which seeks to intertwine the physical world with digital computational methods (Menges, 2015). For instance, his 'Hygroskin' project, a system is designed using wood that responds to its environment, closing in humid and rainy weather and opening in sunny and dry conditions (**Figure 16**). These systems, capable of movement without a motor, can be discussed within the theme of *material as a machine* (Menges, 2015). The ability of the form to self-formation in physical realm brings

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the narrative of form evolution to a stage where organic vitality is being explored.

To delve deeper into the discussions, Neri Oxman's approach of *material ecology* can be analyzed. She aims to establish deeper relationships between design and the environment through computational design, digital fabrication, and material behavior (Oxman, 2012; 2015). In 'Living Hybrid Materials' project, forms that respond and adapt to their surroundings are designed and produced using 3D printers (Bader et al., 2016; Smith et al., 2020). **Figure 17** showcases the self-formation process of a leaf-like hybrid material. In addition to Menges' *material synthesis*, *material ecology* shows that materials are programmed and fabricated from scratch.

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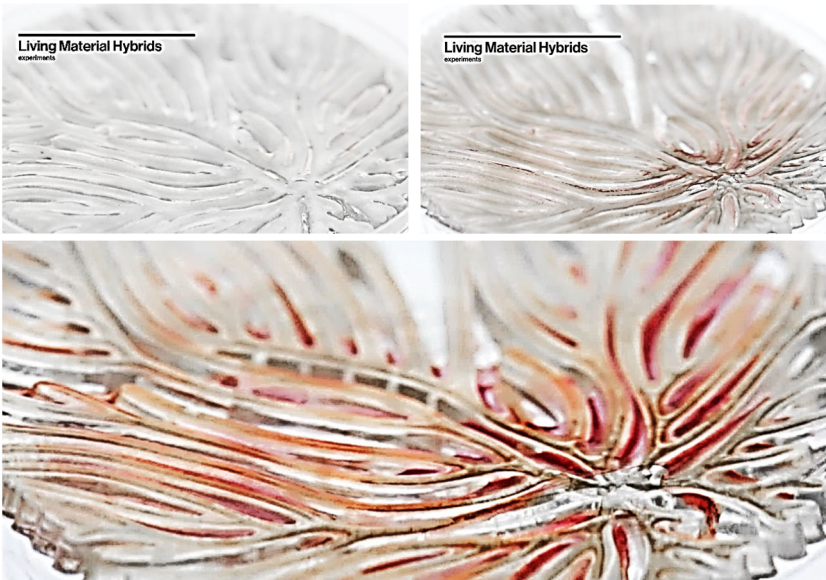
The narrative of form evolution, driven by factors like events, phenomena, concepts, theories, evolving technologies, and techniques, can be further continued through various ongoing research. As the narrative unfolds, it becomes clear that forms, once designed symbolically and produced statically, now possess a more dynamic and generative nature, imbued with new meanings. This newfound meaning and the state of exploration will be discussed in detail in the subsequent section of the study.

3. THE STATE OF *VITAL FORM*

In the study, a new concept is proposed under the title of *'vital[2] form'* to understand, discuss, and critically examine the new characteristics of form which discussed in the first part.

First of all, to comprehend this new concept, it is necessary to understand the state of *being vital / alive / living:*

Alexander (2002) states, "All space and matter, organic or inorganic, has some degree of life in it, and that matter/space is more *alive* or less *alive* according to its structure and arrangement." This idea aligns with DeLanda's (1992) concept of *having life* as self-organizing, dynamic, and interactive systems beyond the individual organism. Likewise, Deleuze (1969/1995) emphasizes the continuous flow, movement, differentiation, and creative power associated with *being alive*. In addition to these, the theory of *autopoiesis* describes *living beings* as self-renewing, autonomous, and dynamic entities characterized by continuous change (Varela et al., 1974). According to these approaches, the state of *being vital* can be defined through subcategories such as being dynamic, generative, autonomous, and interactive.

After analyzing the concept conveyed by the state of *being vital / alive / living*, the focus can be directed towards what *vital form* signifies:

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[2] *Vital* as a word can be seen in various discussions, such as Giedion's (1941) space and time, Bergson's (1911/1944) élan vital, Tange's *metabolism* and *vitality* approach (Tolunay Berber & Özkar, 2020) and more. The choice of this word to convey the intended meaning has been informed by these usages.

Vital form is introduced to engage in a discussion that aligns with the new positions acquired by the form throughout the narrative and the emergence of its new states. It criticizes the state where form is designed symbolically or made statically. If *form* represents the expression of a spatial volume, then *vital form* can be described as a spatiotemporal dimension and includes a notion of process. *Vital form* can be understood as the state that emerges when the *form* is considered at the spatiotemporal level, involving all four dimensions. It is concerned with the process of *formation* rather than the final and static state of *form*. Within the literature, the discussions focus on the concept of '*becoming*' rather than just '*being*' (Deleuze, 1969/1995) and '*formation*' rather than just '*form*' (Oxman, 2006; Alaçam, 2019).

In alignment with the characteristics described in the state of being vital, *vital form* can be expressed through being dynamic, generative, autonomous, and interactive:

> **Being dynamic:** *Vital form* transcends the spatial boundaries of the three dimensions and explores the possibilities of the fourth dimension, which involves the spatiotemporal dimension and allows for a process-oriented existence.
> **Being generative:** *Vital form* is created through a bottom-up model rather than a top-down representation, allowing for generative potential.
> **Being autonomous:** *Vital form* shows self-organization and self-formation and emerges presenting unexpected outputs by resembling the intelligence of the human designer.
> **Being interactive:** *Vital form* can reshape itself in response to environmental stimuli and being sensitive to the given external data in the physical environment.

Vital form serves as a comprehensive framework that integrates theories underlying this concept within the narrative. It can be juxtaposed with existing approaches in the narrative of form evolution, allowing for an interpretation of their interconnections and elucidating its significance. It is crucial in differentiating *vital form* from other form-related definitions and comprehending its contributions to the field. In

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Figure 18, the relationship between the *vital form* and other related form definitons can be observed:

For example, in the digital realm, the relationship between Terzidis' *algorithmic form* and Lynn's *animate form* can be explored within the context of *vital form*. Briefly stated, a*nimate form* is defined as a state that emerges through various processes of digital form-finding (Lynn, 1999), while *algorithmic form* refers to a bottom-up state constructed through algorithms in the digital realm (Terzidis, 2005). Picon (2010) highlights the distinction between these two definitions by suggesting that *algorithmic form* goes beyond mere animation and implies a state of *being alive*. Consequently, *animate form* can be associated with qualities of vital form such as *dynamism* and *autonomy*, while *algorithmic form* can be linked to attributes such as *dynamism*, *generativity*, and *autonomy*.

On the other hand, in the physical realm, the relationship between dECOi's *hyper-form* and Menges and Oxman's material computation-based form approaches can be explored within the context of *vital form*. Shortly, the *hyper-form* refers to a state created interactively through mechanical systems (dECOi Architects, 2000), while the other involve a state generated interactively based on material intelligence (Menges, 2012; Oxman, 2012). Soulaf (2019) emphasizes the distinction between these two situations, offering an example where one system relies on electrical and mechanical components, while the

other is dynamic and interactive due to its inherent material properties. As a result, both approaches can be associated *vital form's* dynamism, autonomy, and interactivity.

While the concepts/approaches described in the narrative represent singular and specific instances, the concept of *vital form* aims to encompass both the digital and physical realms with a holistic approach. In the next section of the research, the meaning of *vital form* is discussed in more detail, using a more comprehensive model to explore its distinctions from *form*.

4. A CONCEPTUAL MODEL TO COMPREHEND *VITAL FORM*

To better articulate the *vital form* and to analyze its difference from *form*, a conceptual model is generated through the *deconstruction*[3] of the evolution narrative of form, which is constructed on the first chapter linearly by following the chronological order.

The narrative of form evolution explores the changes in form within a historical context, examining the practices of design and making. However, it does not distinguish between the design and making stages. During the *deconstruction* of the narrative on this part, a dialectic between *form design* and *form making* emerges when analyzing *form* and *vital form*. In order to compare and understand the states of *form* and *vital form* in these two completely different phases, it is necessary to first accurately distinguish these phases.

Examining the various approaches of thinkers from different centuries can enrich this discussion:

While Aristotle (4th century BC/2019) discusses *potentiality* and *actuality*, Alberti (15th century/1988) talks about *lineament* and *structure* (Tan & Paker, 2018; Roth, 1993; Forty, 2004), and Deleuze (1977/2007; 1969/1995) presents *virtual* and *actual* terms (Deleuze & Guattari, 1980/1987; Sönmez, 2020). The first concept addressed by these three thinkers —*potentiality*, *lineament*, or *virtual*—refers to a

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[3] The concept of *deconstruction* is used to analyze through the parts, disrupting the integrity of the structure (Derrida, 1967/2001).

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stage where something has not yet occurred in the physical world but has the potential to happen. This can be thought of as the *form design* in an immaterial environment. The second concept —*actuality*, *structure*, or *actual*—represents the realization of something in the physical world. It denotes the *form making* in a material environment.

Based on this theoretical framework, in the emerging model, *form* and *vital form* are separately addressed and compared in the *design* and *making* phases. And to facilitate a clean examination, the model has been designed as a matrix allowing for cross-referencing and comparison. The X-axis of matrix represents ***form*** and ***vital form,*** while the Y-axis represents the ***design*** and ***making phases***. Additionally, to facilitate this arrangement and group the pieces together, various subdivisions within the matrix are created through form design and making methods. For instance, distinctions such as analog or digital, two-dimensional or three-dimensional, and scaled or 1:1 scale, etc. **Figure 19** illustrates the placement of events that are sequentially arranged in the narrative onto the matrix plane. Each deconstructed section of the narrative falls onto the matrix under its relevant title.
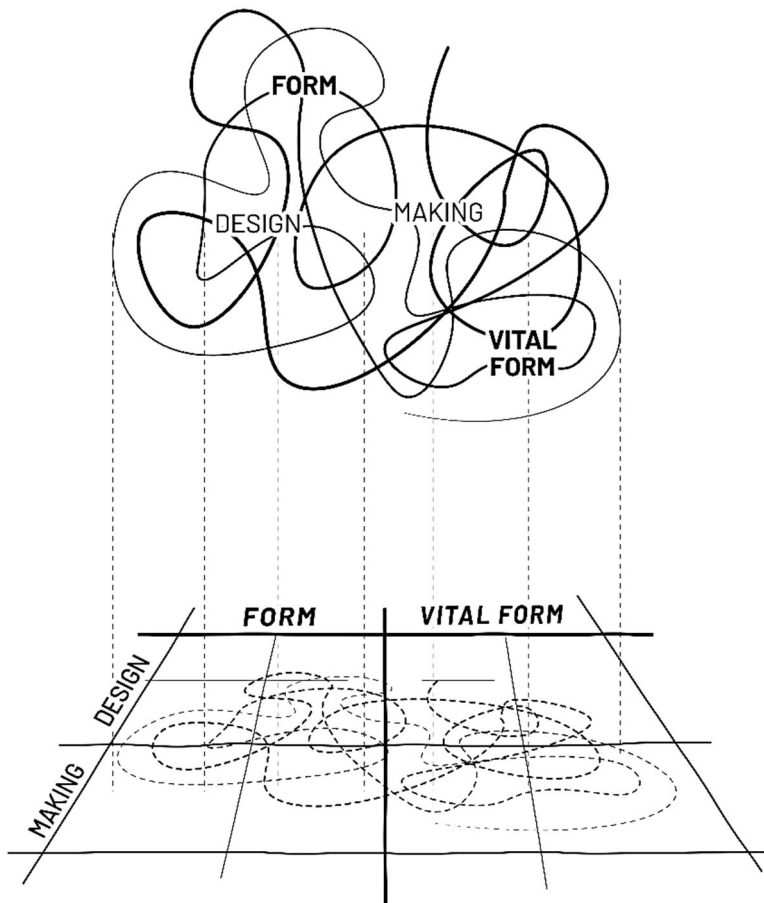
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Figure 20 illustrates the placement of each theory/event/approach conveyed in the narrative of form evolution into the matrix that has been created to better understand the *vital form.*

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	FORM			VITAL FORM		

DESIGN PHASE

TRADITIONAL DRAWING *PERSPECTIVE*	DIGITAL DRAWING *AUTOCAD*	2D	PARAMETRIC DRAWING *SKETCHPAD* *SPLINES*		2D
	DIGITAL MODELING *CATIA*	3D	COMPUTATIONAL MODELING *ALGORITMIC FORM* *GENERATIVE FORM* *ANIMATE FORM* *MORPHOGENESIS*		3D
ANALOG	*DIGITAL*		*DIGITAL*		

MAKING PHASE

ANALOG MODELING	DIGITAL FABRICATION *LYNN: EMBRYOLOGICAL HOUSE*	SCALED MODELS	ANALOG MODELING *GAUDI: HANGING CHAIN* *ISLER: CURVED THIN CONCRETE* *OTTO: MATERIAL LAB*	DIGITAL FABRICATION *EMTECH & MENGES* *MATERIAL EXPERIMENTS*	SCALED MODELS
ANALOG	*DIGITAL*		*ANALOG*	*DIGITAL*	
TRADITIONAL FABRICATION	DIGITAL FABRICATION *EMTECH: HONEYCOMB*	1:1 SCALE	MECHANICAL SYSTEM *DECOÏ: HYPOSURFACE*	MATERIAL COMPUTATION *MENGES: HYGROSKIN* *OXMAN: LIVING HYBRID MATERIAL*	1:1 SCALE
ANALOG	*DIGITAL*		*MECHANIC*	*ORGANIC*	

Figure 20: The conceptual model, adapted from (Author, 2023).

*S*ome of the cells of matrix can be examined briefly. For example, when examining through the ***design phase***:

In the ***form*** cell of the ***design phase,*** it can be observed that there is a subdivision under the title of ***analog*** and ***digital*** drawing methods. ***Digital*** drawing also subdivides into ***two-dimensional*** and ***three-dimensional.*** In the examples (such as *Perspective drawing, AutoCAD, CATIA*, etc.), the symbolic, representative, and static state of the form can be seen.

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In the *vital form* cell of *design phase*, examples (such as *Sketchpad,* Lynn's *Spline, Algorithmic Form, Generative Form, Animate Form, Morphogenesis*, etc.) exhibit the *dynamic*, *autonomous*, *interactive,* and *generative* state of the form.

When examining through the *making phase*, it can be observed that cells subdivide into *scaled models* and *1:1 scale:*

In the *form* cell of the *making phase*, all examples (such as *Embryological House's* 3D printed model, *Honeycomb* project, etc.) show representational and static state of form which is produced according to the final form information.

In the *form* cell of the *making phase*'s examples (such as Gaudi, Isler, Otto's *form-finding* experiments, EmTech, Menges' *material behavior* experiments, Hyposurface, Hygroskin, Living Hybrid Material, etc.), *dynamic*, *autonomous*, and *interactive* state of form can be seen during production or after production.

In a general assessment, when examining the examples, it is observed that the *form* cell contains examples where form is designed as representation or produced statically. On the other hand, the *vital form* cell examines *dynamic*, *generative*, *autonomous,* or *interactive* states, incorporating the parameter of time which vary depending on the specific case being examined.

In summary, through the analyzing of which events/theories/approaches are categorized as *form* and which ones as *vital form* within this conceptual model, the aim is to reinforce the understanding of the concept of *vital form*. In this study, the matrix is constructed solely within the framework of the narrative of form evolution. However, in the subsequent stages, the matrix can be further developed and enriched by incorporating theories, approaches, practices, and comparative readings that contribute to the discussions on *form* and *vital form.*

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5. CONCLUSION

It is observed that the concept of *vital form,* which criticize symbolic and static state of form, has evolved with paradigm shifts, incorporating qualities like dynamism, autonomy, generativity, and interactivity. If read through the evolution narrative established in the initial stage of the study, in the Analog Era part, its definition was limited to *dynamism* and *autonomy*. However, it appears that in later the Digital and Millennium Era sections, its definition has expanded over time to include *generativity* and *interactivity*. It indicates that the concepts and definitions are open to development. Therefore, it is important to emphasize that evolution is ongoing, and both *form* and *vital form* continue to evolve.

The future scenarios of the study can explore the ongoing evolution of *vital form* and the emergence of alternative understandings. For example, Allen (1997) proposes a *field theory* that views architectural buildings as dynamic systems interconnected on a network. In this framework, form extends beyond the building envelope, inviting a holistic perspective. In this point, *vital form* can be open to discussion as a *vital space* that encompasses not only form but also all elements of architectural design. It can be defined as an environment intimately connected with its inhabitants, continuously evolving and responsive to their movements in real-time. It is not merely a surface, but a space that surrounds and swarm arounds the users. It can also be characterized as a generative entity that is constructed and deconstructed in a real time according to the user within it.

From another perspective, the future scenario discussions can be continued on *design* and *making* practices. To feed into this discussion, Kiesler's critique can be examined:

"If God had begun the creation of man with a footprint, a monster (of) all heels and toes would probably have grown up from it, not a man. He might have been without a head and arms, to say nothing of his internal structure. Fortunately, the creation proceeded otherwise, growing out of a nuclear conception." (Kiesler, 1949).

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Introducing *vital form* within architectural design studios can enhance form investigations and foster innovation. For example, a kind of design tool can be developed to generate the praxis of *vital form* through practical application to explore and advance *form design and making processes*. It can foster a forward-thinking and innovative approach to form investigations, challenging conventional methods and opening new possibilities.

The ongoing discussions on future scenarios can further explore new inquiries and possibilities in form by utilizing various examples. The intention is not to provide definitive answers but to spark curiosity, inspire exploration, and encourage critical thinking about the future trajectories of form in architecture. This study which examines form as an evolving concept and introduces the concept of *vital form* as its ultimate state aims to create awareness, explore new potentials, and foster critical thinking about form in architectural design.

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Conflict of Interest Statement

The authors of the study declare that there is no financial or other substantive conflict of interest that could influence the results or interpretations of this work.

Author Contribution

The authors declare that they have contributed equally to the manuscript.

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