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Original Research Article

The Concept of Space: Physics, Philosophy, and Art in Contemporary Sculpture Education from a Connectivism Perspective*

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Abstract

Problem statement: The concept of space in sculpture is a multilayered and interdisciplinary phenomenon formed through its relationship with perception, the body, materiality, and meaning. The historical development of this concept shows that space has shifted in physics from an absolute structure to a relative framework; in philosophy, from an a priori category to a phenomenological experience; and in sculpture, from a static background to a dynamic element in the production of meaning. These transformations underscore the complexity of space and reveal the need for a network-oriented approach to its teaching in contemporary sculpture, one that can meaningfully connect theoretical knowledge with students' practical capabilities. Drawing on the theory of connectivism learning, this study asks how an integrated synthesis of physical, philosophical, and artistic perspectives can contribute to the development of a novel and effective model for teaching the concept of space in contemporary sculpture education.

Research objective: The aim of this study is to propose a network-based model for teaching space in sculpture education, in which philosophical, physical, and aesthetic knowledge are organized as interconnected nodes within a conceptual network, thereby enabling the enhancement of students' abilities to analyze and create space.

Research method: This study adopts a qualitative approach and employs a descriptive–analytical method with an applied–developmental orientation. Data were collected through two main pathways: a library-based study of the concept of space in physics, philosophy, and art, and a field study involving the analysis of selected works by contemporary sculptors as well as final projects by sculpture students at the University of Tehran. Data analysis was conducted based on the network logic of connectivism theory, in order to elucidate the relationships among different layers of space in the educational process and to justify the rationale for the selected methodological approach.

Conclusion: The findings indicate that concurrent attention to the physical and philosophical layers of space elevates students' understanding from the level of sensory experience to a more analytical and creative level. Accordingly, it is recommended that the concept of space in sculpture be reconfigured through a connectivism approach so that its instruction is not confined to the recognition of form, but rather the relations among form, space, and meaning are apprehended as a networked, multidimensional phenomenon.

Keywords: *Sculpture education, Concept of space, Interdisciplinary approach, Physics, philosophy, Connectivism learning.*

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Introduction

The concept of space has long occupied a foundational position in physics, philosophy, and the arts. Contemporary developments in physics, from Einstein's theory of relativity to quantum mechanics, together with phenomenological and post-Kantian philosophical perspectives, suggest that space is a dynamic and relational phenomenon closely connected to human experience. Consequently, when the teaching of space in sculpture is limited solely to the recognition of form, students are deprived of opportunities to engage with the theoretical, physical, and perceptual dimensions of space.

The shared vocabulary of concepts such as space, volume, force, and light across science and art points to the connective capacity of these notions (Shlain, 1991, 19). Nevertheless, a significant research gap persists between philosophical and physical theories of space and their practical implementation in sculpture education. Previous studies have largely concentrated on the perceptual and aesthetic dimensions of space, leaving its theoretical and interdisciplinary potentials underexplored. Drawing on connectivism learning theory, the present study seeks to address this gap by proposing a network-based model in which physics, philosophy, and art are conceptualized as interconnected nodes within a knowledge network, and meaning emerges through the relationships among them. This approach enables students to move beyond primary sensory experience and a form-centered perspective toward a deeper understanding of the relationships between form, space, and meaning.

The primary research question guiding this study is: How can the teaching of the concept of space in sculpture be transformed through the application of connectivism learning theory and the integration of philosophical, physical, and artistic knowledge nodes? The secondary research question examines how this pedagogical approach influences students' understanding of space and how such shifts are reflected in their artistic production. Accordingly, the aim of this study is to propose a novel, network-oriented approach to teaching the concept of space, one in which learners simultaneously engage with scientific, philosophical, and aesthetic perspectives, thereby contributing to the formation of a new discourse in sculptural practice.

This qualitative study adopts a combined basic and applied research approach. Data were collected through two principal methods. First, a library-based review of philosophical, physical, and artistic sources related to the concept of space was conducted. Second, field-based studies included the analysis of selected works by contemporary international artists and the final projects of sculpture students at the University of Tehran. Data analysis was carried out in accordance with connectivism theory, whereby each knowledge domain; physics, philosophy, and art, was treated as a node within a broader learning network, and meaning was constructed through the interactions among these nodes.

The findings indicate that integrating spatial concepts within contemporary sculpture education is both feasible and pedagogically productive, demonstrating that the teaching of space extends beyond the mere transmission of technical skills. The central innovation of this study lies in the development of an integrated, network-based framework for sculpture education that reconceptualizes space from a purely formal element into an active and dynamic component of the learning and creative process. Moreover, this framework provides a foundation for designing interdisciplinary curricula that connect art education with the theoretical sciences.

Literature Review

The concept of "space" in sculpture has long constituted one of the field's most fundamental theoretical and aesthetic concerns, and it has been examined from scientific, philosophical, and artistic perspectives. In the Iranian literature, the doctoral dissertation by Mazhab Jafari (2015) titled " The concept of space in sculpture and architecture of the second half of the twentieth century", identifies space as a decisive factor in the formation of meaning and emphasizes its role in processes of production and reception. While this study highlights the theoretical importance of space, it does not address the pedagogical dimensions or the transmission of this concept in educational contexts. Ghoddusi Far (2011), in the article "Space in Contemporary Sculpture," argues that attention to

space constitutes a reaction against the dominance of volume in traditional sculpture; contemporary artists, he contends, provide the viewer with space-centered experiences rather than privileging the independent object. His analysis, however, is primarily aesthetic and does not engage with implications for art pedagogy.

International scholarship similarly has tended to approach space mainly from perceptual and phenomenological perspectives. Lorentzen (2019), in "Sculpture and the Sense of Place," asserts that spatial perception is not produced solely by vision but is a multisensory, embodied phenomenon. Hopkins's (2003, 2010) studies on "Sculpture and Perspective" and "Sculpture and Space" emphasize that spatial experience depends on movement and the viewer's angle of observation. Jason (2005) in "Space is place," and Potts (2001) in "Installation and sculpture", stress the significance of environmental context and the site of an artwork in forming spatial experience. One classic text in this field is Rosalind Krauss's (1979) essay "Sculpture in the Expanded Field," which emphasizes the dissolution of traditional boundaries among sculpture, architecture, and landscape and locates space as a fundamental component of artistic practice. Although these works are seminal for understanding the aesthetic and perceptual dimensions of space, they have principally focused on analysis rather than on pedagogical transmission.

Alongside the artistic literature, the learning theory of connectivism offers a novel framework for examining the concept of space from a networked perspective. The theoretical framework of this study is grounded in the works of George Siemens and Stephen Downes, who conceptualize knowledge as a distributed phenomenon and define learning as the result of establishing connections among nodes of knowledge. In writings such as Connectivism: A Learning Theory for the Digital Age and Knowing Knowledge, Siemens (2004, 2008) emphasizes the role of network structures in the formation of knowledge. Similarly, in articles including "An introduction to connective knowledge" and "Learning Networks and Connective Knowledge", Downes (2005, 2010) highlights the significance of participation, self-organization, and interpersonal connections in the learning process. Wu & Cui (2022) , in one of the relatively few articles that apply connectivism theory to art education, consider the theory chiefly for the revision of theoretical art courses rather than for practice-based instruction. In Iran, Eskandari (2010), in a doctoral dissertation titled Epistemological Elucidation and Critique of Connectivism Theory Based on Islamic Realism and the Presentation of Teaching–Learning Components from That Perspective, introduces and critiques the epistemological foundations of connectivism but does not extend the discussion to its application in art education.

A review of the literature reveals that none of the existing studies adequately answers the principal question of the present research. Art and sculpture studies have concentrated on the aesthetic analysis of space and on the spectator's perceptual experience, while the educational aspects of teaching the concept of space in sculpture remain underexamined. Likewise, the connectivism literature offers a networked learning framework but has not addressed the application of that framework in practical art courses or the transmission of complex conceptual content such as "space." Moreover, no prior research has integrated the three domains of physics, philosophy, and sculpture within an interdisciplinary framework aimed specifically at teaching the concept of space. By bringing these three domains together within a connectivism theoretical framework, the current study proposes a networked model for understanding and teaching the concept of space and thereby aims to fill a substantive gap in the prior literature.

Theoretical Foundations of Connectivism Learning

Learning theories provide conceptual frameworks for understanding education and the processes through which knowledge is transmitted and transformed. During the twentieth century, three major paradigms; behaviorism, cognitivism, and constructivism, played central roles in educational development. Behaviorism emphasized stimulus–response relationships, cognitivism focused on internal mental processes, and constructivism highlighted active learning and individual experience. However, in contemporary networked and

digital societies, these approaches alone are no longer sufficient to address the growing complexity of learning processes.

Within this context, connectivism was introduced by George Siemens (2004, 2008) and Stephen Downes (2005, 2010) as a learning theory suited to the conditions of the digital age. From a connectivism perspective, knowledge is understood as a distributed and dynamic phenomenon that exists within a network of nodes; such as individuals, concepts, or technological systems, and learning is defined as the capacity to form connections among these nodes and to generate meaning through those connections.

Drawing on complexity[1] theory and chaos[2] theory (Mitchell, 2009/2015, 14), connectivism conceptualizes learning as a nonlinear and unpredictable process. The metaphors of the network and the learning ecosystem further suggest that, just as natural ecosystems emerge from interactions among diverse elements, meaning in learning ecosystems arises from the dynamic interplay among learners, concepts, and resources (Cormier, 2008, 2 & 3). Three foundational principles of connectivism are particularly significant for the present study: (a) knowledge formation occurs within networks composed of diverse sources; (b) learning requires the ability to recognize and interpret relationships among concepts; and (c) decision-making and the selective engagement with information are integral components of learning (Siemens, 2004). These principles are directly applicable to the analysis of sculpture projects and to the understanding of space as a multilayered phenomenon.

Based on this theoretical framework, the analytical model of the study is structured around four primary nodes. The physical node of space enables the analysis of sculptural behavior through concepts such as balance, force, light, scale, and movement. The philosophical node of space focuses on embodiment, lived experience, and kinesthetic perception. The artistic and aesthetic node examines installation practices, participation, and the relationship between the artwork and its contextual environment. Finally, the connectivism node facilitates the integration and networking of the other three nodes, enabling a multidimensional understanding of space.

Within this framework, the analysis of students' sculptural projects is conducted in a networked and interdisciplinary manner, allowing for the simultaneous examination of the physical, philosophical, and artistic dimensions of space. In this way, connectivism theory demonstrates how students establish connections among diverse bodies of knowledge, while the role of the instructor shifts from that of a transmitter of information to a facilitator of learning networks. This structure clarifies the direct relationship between the theoretical foundations of the study, the analysis of data, and the response to the central research question, thereby enabling a multidimensional understanding of the concept of space.

Knowledge Nodes of the Concept of Space: Physics, Philosophy, and Sculpture

Within a connectivism approach, no single knowledge domain is capable of providing a comprehensive explanation of space. Accordingly, the concept of space is examined from an interdisciplinary perspective through three interconnected knowledge nodes; physics, philosophy, and sculpture, with meaning and experience emerging from their interaction. Physics conceptualizes space as relative and dynamic, philosophy understands it as a lived and embodied experience, and contemporary sculpture conceives of space as an active and participatory element in the creation of the artwork (Table 1).

• Space in physics: From absolute structure to a dynamic field

In classical physics, space was conceived as an absolute arena independent of matter. Aristotle regarded it as the natural place of things, and Newton, in the seventeenth century, defined space as three-dimensional, static, and metrically determinable (Fig. 1-1). This absolutist view dominated both the sciences and the arts until the nineteenth century. The emergence of non-Euclidean geometry opened the possibility of curved space, and Leibniz[3] offered a relational account according to which space is the result of relations among bodies, an outlook that helped prepare the ground for modern physics (Rovelli, 2016, 10).

In the twentieth century, Einstein's special theory of relativity demonstrated that space is a dynamic

phenomenon dependent on the motion of the observer (Al-Khalili, 2020, 33). In general relativity, spacetime has a four-dimensional structure (Fig. 1-2), and mass induces curvature in space; gravity is therefore not an independent force but a consequence of spacetime geometry (Shu, 2025a). This perspective transformed the static model of the universe. Quantum mechanics also offered a new image of space. Heisenberg's[4] uncertainty principle shows that a particle's position and velocity cannot be simultaneously determined, and at subatomic scales space is dynamic and filled with fluctuations (Khalili, 2020, 50-58). The integration of general relativity and quantum theory within the framework of loop quantum gravity led to the conception of space as a discrete structure (Shu, 2025b).

• Contemporary Theories: Multidimensional and Information-Centred Conceptions of Space

Contemporary physics offers new perspectives on the nature of space. In Big Bang cosmology, the universe begins with the expansion of spacetime from an extremely dense and hot state (Rovelli, 2016). String theory conceives of the fabric of reality as vibrating strings embedded in a higher-dimensional space whose extra dimensions are compactified and imperceptible at human scales (ibid., 30). Multiverse interpretations and eternal inflation posit the possible existence of parallel universes with different physical laws (Aguirre, 2025) (Fig. 1-4).

Information-theoretic and holographic approaches reconceptualize spacetime not primarily as a material substrate but as an emergent phenomenon arising from information and entropy. Complexity and chaos theories, emphasizing nonlinear behaviors, likewise describe space as a dynamic, self-organizing, and multilayered structure (Gleick, 2011).

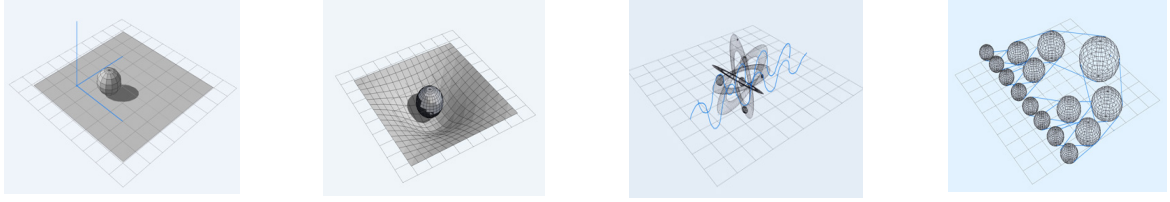
Consequently, in contemporary physics, space is not a neutral receptacle but a dynamic network of relations, forces, and information. This perspective accords with modern and contemporary sculptural thought insofar as artists likewise conceive of space not as a mere backdrop for forms but as an active element in the generation of meaning. Such a conception, when introduced in pedagogical settings, helps students to experience space as an energetic and mutable material (Shu, 2025; Gleick, 2011).

• Space in philosophy: From a priori perception to lived experience

The concept of space has long been one of philosophy's foundational concerns and has been redefined in each epoch in accordance with shifting epistemological and ontological presuppositions. In classical philosophy, Plato situated space between the world of ideas and material reality, while Aristotle defined it as the "place" of things (Safiyan & Momeni, 2011, 67-69). In the modern period, Descartes treated space as the extension of matter (Mansouri, 2015, 64). Kant constituted a

Table 1. Selected studies. Source Authors.

Knowledge Node	Analytical Criteria	Application in the Study
Physical	Balance, force, scale, light, movement	Analysis of spatial organization and the behavior of sculptural forms
Philosophical	Embodiment, lived experience, kinesthetic perception	Analysis of students' and viewers' spatial experience
Aesthetic/ Sculptural	Installation, participation, relationship between artwork and context	Analysis of artistic aspects and the creation of space
Educational/ Connectivism	Integration of physical, philosophical, and aesthetic nodes	Multidimensional learning and understanding of space in sculpture



1. Newtonian space 2. Relational/relativistic space 3. Quantum space 4. Parallel/multiverse models

Fig. 1. Relationships between object and space across different physical theories. Source: Authors.

turning point in the philosophical understanding of space by describing it as an a priori form of intuition, i.e., a necessary condition that makes sensory experience possible thereby locating space in the subject rather than in the external world (Mobasheri, 2007, 117 & 118).

In the twentieth century, with the rise of phenomenology, space acquired the status of lived meaning. Heidegger (1971, 144-159) rejected a purely geometric conception of space and presented it as an outcome of "being-in-the-world," arguing that human dwelling, action, and movement enact and thereby constitute space. Merleau-Ponty (2004/2012, 24), emphasizing the lived body, characterized space as a dynamic phenomenon perceived through bodily situatedness. Lefebvre[5] (1991, 50-70), in turn, regarded space as a product of social and cultural relations, showing how it is formed in connection with power structures and social contexts.

On the basis of these perspectives, space is neither purely mental nor absolute; rather, it is a process that emerges in relation to human beings, society, and the environment. This phenomenological orientation provides a theoretical foundation for contemporary sculpture because the artwork does not merely inhabit space but actively organizes it, thereby transforming it into a lived experience.

- **Space in sculpture: From object to field of perception**

In the classical tradition, the sculptural object was understood as an autonomous entity, and the artist's aim was the representation of the ideal human body situated within a fixed spatial order (Fig. 2). With the advent of linear perspective during the Renaissance, the concept of space changed profoundly: Panofsky (1991, 728) nargued that perspective functioned not merely as a visual tool but as a cultural language for representing the world. In the twentieth century, parallel transformations in scientific and philosophical conceptions of space prompted artists to reconceptualize its nature. Brâncuși, Barbara Hepworth, and Henry Moore, for example, integrated form and space so that space became an intrinsic structural component of the work (Todorov, 2014, 18–20) (Fig. 3). Cubist artists such as Picasso and Braque, by juxtaposing multiple viewpoints simultaneously, advanced new modes of spatial perception (Golding, 1988, 47).

In works by Umberto Boccioni, such as Development of a Bottle in Space (Fig. 4), as well as in the practices of Constructivist artists including Naum Gabo, space penetrates the interior of form, transforming sculpture from a closed mass into an open and analytical structure (Wood & Kelly, 2019, 39) (Fig. 5). Marcel Duchamp, through the use of readymades, reconceptualized space as a conceptual field for rethinking the nature of the artwork itself, thereby shifting sculptural practice from material form toward intellectual and contextual inquiry (Krauss, 1981, 70–81).

With the emergence of Minimalism in the 1960s, sculpture shifted from a self-contained object to a spatial and perceptual experience. Simple, repetitive forms derived meaning through their relations to

Fig. 2. Pietà, sculpture by Michelangelo (1499). Source: www.gettyimages.fr.

Fig. 3. Pelagos, sculpture by Barbara Hepworth (1946). Source: www.tate.org.uk.

the viewer's body (Causey, 1998, 11). The removal of plinths and the replacement of the traditional vertical axis with a horizontal orientation enabled works to be placed directly on the gallery floor (Collins, 2007, 7) (Fig. 6). During this period, theorists advanced contrasting positions: Arthur Danto[6] emphasized the participatory role of the viewer, whereas Michael Fried regarded such participation as a challenge to the autonomy of the artwork, an issue discussed in the literature (Moszynska, 2013, 14). From this perspective, space is not merely a neutral display surface but an organizing agent that links dispersed elements into a coherent whole (Todorov, 2014, 20). Understanding this transformation is pedagogically crucial: it demonstrates that space is not a fixed container but an active component, and students' awareness of these changes moves them beyond the reproduction of traditional models toward the capacity to create new, intentionally conceived spatial experiences.

In the final project by Hanieh Haji-Mirza, two geometric wall, configured in a minimalist idiom and inspired by Iranian traditions of spatial organization were reimagined to evoke the learner's lived experience. One wall, clad with mirrored surfaces, converts a rigid boundary into a dynamic, reflective plane; the other, composed of colored tiles, creates a structured, geometric spatial field. Interaction with light and shadow through viewers' movement transforms the perception of space (Fig. 7). Analyzing these knowledge nodes reveals the layered meanings of space and, by integrating them, enables the formulation of a coherent and generalizable model for teaching contemporary sculpture. Accordingly, the

Fig. 4. Development of a Bottle in Space, sculpture by Umberto Boccioni (1913). Source: www.metmuseum.org

Fig. 5. Linear Construction in Space, sculpture by Naum Gabo (1945–1946). Source: www.guggenheim.org.

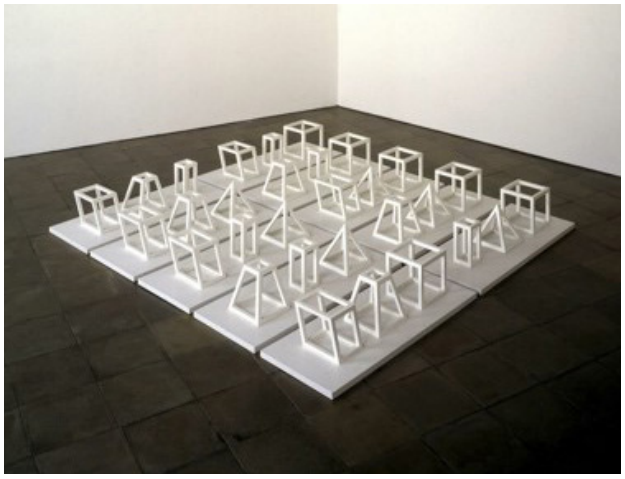


Fig. 6. Geometric Structures, sculpture by Sol LeWitt (1979). Source: www.lissongallery.com.

Fig. 7. Installation artwork by Hanieh Haji-Mirza, Installation. Photo: Hanieh Haji-Mirza, 2018.

transformation of the concept of space across three historical periods is organized and analyzed within the framework of a network of epistemic nodes (Table 2).

Field of Experience

The three-dimensional nature of sculpture makes it a distinct medium that is intrinsically bound to real space. In contemporary sculpture, space functions as a dynamic field of perception, movement, and interaction in which the viewer becomes part of the artwork's structure and meaning is produced through reciprocal engagement with the spatial field. This view reflects Merleau-Ponty's (1962) phenomenology, which characterizes spatial perception as an embodied phenomenon. Accordingly, pedagogy in sculpture should prioritize the acquisition of spatial understanding through sensory experience rather than exclusively through vision or conceptual reflection; movement within space, changing viewpoints, and haptic contact with material are integral components of the learning process.

F. David Martin (1976, 279), drawing on Heideggerian thought, contends that sculpture belongs to our real world and thus participates in it. Zuckert (2009, 290) emphasizes the visual aspect of spatial experience, whereas Meewon Kwon who distinguishes among real, mimetic, and abstract spaces, argues that space is real only insofar as it depends on viewer participation (Celia-Zoeliner, 2017, 4). Hegel (1835/1975, 702) locates sculpture in an essential relation to its social and spatial milieu, and Herbert Read famously asserted that "space is luxury for the painter but necessity for the sculptor," underscoring the medium's ontological dependence on spatiality (George, 2014, 128).

From Michelangelo's Pietà to Claes Oldenburg's oversized hamburger (Fig. 8), sculptural works across historical periods demonstrate that sculpture not only occupies space but actively transforms it (Rawson, 1997, 66). Martin further contends that this spatial engagement can have a therapeutic function, inviting viewers to re-locate themselves within the physical world (Jason, 2005, 6). In the final project by Omid Afarinzad, titled Simultaneity, a volumetric form is presented without reliance on a traditional plinth, combining an artificial rock with a table and shelving to dissolve the boundary between "autonomous object" and "environment," thereby enacting a spatial transformation (Fig. 9).

Space, Body, and Perception

In contemporary sculpture, space is simultaneously a physical and a mental dimension that is constituted in relation to the body and to volumetric form; the movement of the viewer therefore becomes an integral aspect of perceptual engagement. Gaston Bachelard understands space as a lived realm in which memory and imagination are present, and thus as a site of poetic experience (Bachelard & Jolas, 2014, 185–190). Perception of sculpture depends on multiple senses: haptic contact and textural qualities play a fundamental

Table 2. A network of conceptual nodes of space across three historical periods Source: Authors.

Node	Classical	Modern	Contemporary
Physics	Space as a static and absolute container, independent of matter	Space as relative and dynamic, dependent on the observer	Space penetrates form; integration of movement, perception, and volume (Hepworth, Gabo, Boccioni)
Philosophy	Space as the natural place of objects; a fixed and limited mental structure	Subject-centered space; lived and socially constructed experience	Space as relational and experiential; constituted through bodily movement, perception, and interaction
Sculpture	Neutral background; form independent of space (Michelangelo)	Space integrated into form; emphasis on perception and movement (Hepworth)	Interaction of volume and space; rhythm, geometry, and gradual spatial experience (Sol LeWitt)
Representative Works			

role in the encounter with a work. As Rachel Zuckert has shown in her analysis of Herder, Langer, and Vance, the notion of a "tactile space" lies at the core of sculptural experience (Zuckert, 2009, 285–299).

Accordingly, sculpture pedagogy should enable students to experience space as a malleable material. Exercises that generate space by means of light or sound, independently of mass expand students' spatial understanding toward a dynamic, experimental field. In Maral Mostafizadeh's project, for example, images of the city are projected onto rotating vanes while, elsewhere in the gallery, the shadows of a city-like structure composed of wire lines fall onto a dark plane (Fig. 10). From the perspective of the present analytical framework, this work activates both the physical and the philosophical nodes: it provides material conditions for analyzing embodied, multisensory perception and thus offers a rich basis for pedagogical reflection.

Space as a physical structure: Gravity, mass, and scale

Physical forces such as gravity, mass, and scale constitute the material basis of spatial experience. Gravity, as a universal force, determines the balance and suspension of volumes: every sculpture, irrespective of its form or material, establishes a relation to gravity. In contemporary sculptural practice closed, heavy structures have given way to open, suspended, and expansive forms in which mass ceases to be merely a constraint and becomes an expressive element of the work. Gravity thus becomes an active force that artists deliberately deploy. Scale is likewise intimately tied to the human body and shapes bodily perception of space: the size of a sculpture relative to the body, the viewing distance, and the viewer's position are decisive factors. Works near human scale engender a sense of direct encounter, whereas very small or monumental sculptures may evoke intimacy or dominance (Rawson, 1997, 56).

In Borowski's Walking Toward the Sky, for example, mass functions as a signifier of movement and of

Fig. 8. Giant Hamburger, Claes Oldenburg, sculpture.
Source: www.artchive.com.

Fig. 9. Simultaneity, Omid Afarinzad, sculpture.
Photo: Omid Afarinzad, 2018.

Fig.10. Installation art by Maral Mostafazadeh, Installation. Photo: Maral Mostafazadeh, 2011.

collective human striving toward awareness (Fig. 11). In Anahita Ghasemkhani's project Chariots of the Sun, volume, motion, and light are interwoven: wheels beneath the volumes suggest solar movement, while suspended elements intensify the sense of suspension. From the perspective of the physical knowledge node, these spatial experiences demonstrate how gravity and mass affect the viewer's phenomenological response; space is therefore not merely a display medium but a meaningful, active component in the narrative and experience of sculpture (Fig. 12).

Space as Cultural and Social Perception

In contemporary art, the concept of space has expanded beyond geometric and physical definitions to become a cultural, social, and perceptual domain. From Heidegger's perspective, the notion of "dwelling" underpins this view: human beings, through dwelling, constitute space and thereby recover meaning and identity (Heidegger, 1971, 143-162). Accordingly, space functions as the ground of experience, perception, and self-recognition. Henri Lefebvre (1997, 68-151) likewise understands space as the product of social and political relations, showing how it is produced in connection with power structures and social contexts. In contemporary art, a work lacking a specific spatial context is often devoid of meaning, and its perception is formed through its particular site as well as through viewers' movement and temporal engagement.

Farhad Rezaei's installation in the corridor of the Faculty of Fine Arts composed of tall rods and human figures stages a play between weight and suspension that transforms passersby from passive observers into integral elements of the work's spatial field. In this configuration, suspension operates both physically and metaphorically to signify the precarious condition of contemporary existence, and viewers' movement generates continually new modes of experience (Fig.13). In this project, the artistic (site-specific) node is fused with the philosophical node of embodied experience and the physical node of suspension and motion.

In postmodern sculpture, space acquires cultural, social, and political significance. As Celia-Zoeliner (2017, 9) has noted, the physical situation of a work profoundly shapes viewers' perception and interpretation. Doug Aitken's Sonic Fountain 2 which records the sound of water via microphones and replays it through loudspeakers, exemplifies the transformation of space into a multisensory, lived event in which meaning is produced through interaction between the work, its context, and the audience (Richard, 2013) (Fig. 14).

Umberto Eco regards the museum experience of art as a "sacralization" of space because it separates the viewer from everyday life (Causey, 1998, 231). From the 1960s onward, however, the expansion of public and site-specific art challenged this separation, returning sculpture and installation to streets and squares so that artworks could regain meaning within the contexts of social life. Thomas Saraceno's (2019) About the Disappearance of the Clouds, with its clustered transparent structures and soap bubbles, staged environmental precarity and the climate crisis (Fig. 15). Leonardo Drew, by employing charred and suspended materials, transforms the gallery into an unstable, fragmented world that evokes multiple

Fig. 11. Walking to the Sky, sculpture by Jonathan Borofsky. Source: www.borofsky.com.

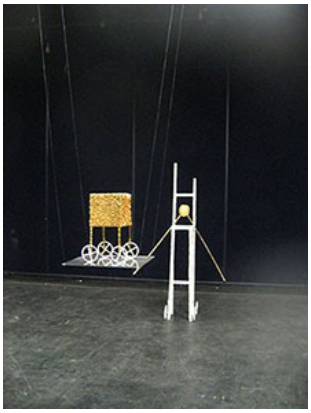


Fig. 12. Chariots of the Sun, sculpture–installation by Anahita Ghasemkhani. Photo: Narges Haririan, 2006.

states and the fluctuations characteristic of quantum-scale physics (Fig. 16).

In a student project, Negin Nasiri arranged everyday objects to convey themes of forgetting and mental fragmentation (Fig. 17), while Sanaz Tayebi organized small units to present an experience of parallel lives (Fig. 18). In both works, space is analyzed through the philosophical-social and embodied nodes, a spatial conception in which the viewer's experience is co-constituted with the work and its context. This perspective holds fundamental pedagogical significance in sculpture education, as understanding space as a perceptual, social, and philosophical phenomenon elevates students beyond purely technical and structural concerns, enhancing their ability to create networked, interdisciplinary experiences through the interaction of the physical, philosophical, and artistic nodes. Consequently, space becomes a dynamic and meaningful system.

Installation: Conceptual and Aesthetic Transformation in Three-Dimensional Art

Installation is among the most significant developments in twentieth-century three-dimensional art, creating multisensory and participatory experiences through the deliberate arrangement of elements in space. Its roots can be traced to the works of Moholy-Nagy, Lissitzky, and Duchamp, continued through the minimalism of the 1960s, and by the 1990s it had emerged as an independent

Fig. 13. Situation, sculpture–installation by Farhad Rezaei.
Photo: Farhad Rezaei, 2019.

Fig. 14. Sonic Fountain 2, installation art by Doug Aitken.
Source: www.labiennaledelyon.com.

Fig. 15. About the Disappearance of the Clouds, installation art by Tomás Saraceno.
Source: WWW.studiotomassaraceno.org

Fig. 16. Assimilation, installation art by Leonardo Drew.
Source: www.southlondongallery.org

Fig. 17. Alzheimer, installation by Negin Nasiri.
Source: Negin Nasiri, 2012.

Fig. 18. I Explore Humans from the Window, installation by Sanaz Tayebi.
Source: Sanaz Tayebi, 2013.

artistic branch (Potts, 2001, 7; Bishop, 2005/2017, 13). Installation redefines the relationship between artwork and context, transforming viewers from passive observers into active participants and, by decentering a fixed viewpoint, challenges the hierarchical structures of Renaissance representation to create a fluid and temporal experience (Panofsky, 1977, 69). In this approach, meaning resides not in the physical object itself but in the process of interaction; as Bourriaud's (2002) relational aesthetics demonstrates, the installation constitutes a space where communication itself becomes the material of the work.

Examples such as Rashid Arayin's Zero to Infinity, based on geometric and chromatic structures, blur the boundaries between artist and audience, between mathematical order and perceptual experience, and analogous to probabilistic systems in quantum physics, render each viewer's movement a distinct experience (Fig. 19). In Negin Soleimani's project, the audience determines the final spatial configuration by selecting keys and opening cabinets, producing an unstable, observer-dependent space that evolves over time (Fig. 20). In sculpture education, this perspective guides students away from a focus on fixed objects toward spatially oriented experiences in which light, sound, movement, and time function as constitutive elements, and space is understood as a dynamic network of forces, perception, and participation.

The analysis of these examples demonstrates that installation functions as a practical embodiment of the conceptual network of space: the physical node is manifested in the behavior of light and the geometric and dynamic structures of space; the philosophical node is activated through bodily engagement and audience participation; and the artistic node organizes elements to create a multisensory, meaningful experience. Connectivism theory facilitates the integration of these layers, indicating that sculpture education is most effective when students can perceive these physical, philosophical, and artistic nodes as a network and integrate them in both the design process and the spatial experience. Consequently, installation operates not only as a tool for analyzing space but also as a guide for redesigning pedagogy and enhancing students' ability to create participatory and meaningful artworks.

Conclusion

The findings of this study indicate that the concept of space in contemporary sculpture is a multi-layered phenomenon, manifesting across three interconnected nodes; physical, philosophical, and aesthetic and cannot be understood merely as a static substrate for the placement of volumes. Analysis of student projects at the University of Tehran within the framework of connectivism learning theory revealed that spatial

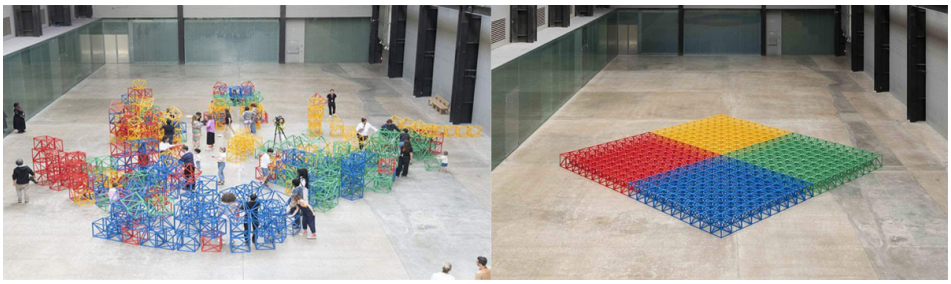


Fig. 18. Zero to Infinity, installation by Rashid Araeen. Source: www.tate.org.uk. © Tate (Lucy Green).

Fig. 20. Magnolia or Hortensia or Mimosa, installation by Negin Soleimani. Source: Negin Soleimani (2023).

understanding deepens when these three domains are perceived not separately, but as an integrated, networked system in which meaning emerges from the dynamic interconnections among knowledge nodes. This approach does not conceive meaning as a linear transmission of information; rather, it arises from the formation of an active network linking experience, theory, and practice.

Within the physical node, space is understood as dynamic, relative, and unstable, manifested in kinetic, suspended, and floating works, replacing the classical perception of stable and static volumes. In the philosophical node, guided by phenomenology, space assumes a lived and perceptual quality, where the presence of the audience plays a fundamental role in meaning-making. In the artistic node, the transition from autonomous volume to interactive installations transforms the boundary between object and environment, turning the artwork into an intra-spatial action.

Therefore, integrating the physical, philosophical, and artistic nodes into a networked framework elevates students' spatial understanding from a purely sensory experience to an analytical, creative, and interdisciplinary level. When students successfully link material, light, embodied perception, and environmental structure, meaningful spatial experiences emerge. This underscores that teaching space is not merely the transmission of technical skills or formal principles; it is a process in which learners must develop the ability to create effective networks between theory and practice. Artistic experience is always contextualized within spatial, temporal, and cultural frameworks, and any analysis of space is meaningful only in relation to these contexts.

The model proposed in this study not only addresses a gap in the literature on art education but also provides a practical, interdisciplinary framework for understanding, analyzing, and teaching the complex concept of space. It demonstrates that integrating scientific, philosophical, and artistic knowledge empowers students to generate meaningful and transformative spatial experiences.

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The authors declare that they have no conflict of interest in conducting this research.

Endnotes

1. An interdisciplinary field that emerged in the 1980s through the research of the Santa Fe Institute and the work of scholars such as Stuart Kauffman and Murray Gell-Mann.
2. A concept in mathematics and physics formulated by Edward Lorenz in the 1960s, which addresses the sensitive dependence of phenomena on initial conditions.
3. One of the founders of modern rationalism.
4. A founding figure in the development of quantum mechanics.
5. A philosopher and a sociologist
6. A philosopher and an art critic

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