More than ever, Moholy-Nagy’s influence circulates within contemporary art and visual media. In this essay, the author reconsidered his extended influence in regard to the complex scientific theories of space-time and molecular forces he invokes in Light-Space Modulator. To do so effectively and provocatively, the author brings on board a fictive resource: “Doctor Who.” Like the TARDIS, Moholy’s kinetic sculpture is conceptually a transdimensional apparatus that figuratively bores through time and space to connect past, present and future and resonates with today’s perception of space-time-light entanglement.

I often had the feeling, when pasting my collages and painting my “abstract” pictures . . . that I was throwing a message, sealed in a bottle, into the sea. It might take decades for someone to find and read it.

—MOHOLY-NAGY

MOHOLY’S RELATIVITY AND SPACE-TIME SENSIBILITY

Prior to taking his pivotally influential position as teacher at the Bauhaus (1923–1928), László Moholy-Nagy had already honed his distinctive cross-disciplinary and experiential approach to art. Early on, he participated in Hungarian activist circles and published articles in MA (Today), a journal dedicated to the revolutionary possibilities of mass media communication. In exile, after the fall of the short-lived Hungarian Soviet Republic, Moholy signed “Manifesto of Elemental Art” (1921), along with Raoul Hausmann, Hans Arp and Ivan Puni [1]. The manifesto announced “the regeneration of art” through the elemental experiences of material and dynamic forces of their era. Once at the Bauhaus, Moholy used his interests in mass communication and engagements with new technological materials, optical effects (light and sound), biotechnology and sensory learning to formulate an innovative, experiential approach to teaching, documenting his pedagogical ideas in Painting, Photography, Film (1925) and The New Vision (1929). Unsurprisingly, he applied his indefatigable spirit of investigation to his practice, expanding his visual explorations into artificial light, radiant projection, sensory perception, organic design and kinetic motion—what he provocatively referred to as the fluctuating play between tensions and forces.

While his influence as a teacher has always remained legendary, more recently renewed enthusiasm for Moholy’s near-scientific inquiries into visual perception has led to a resurgence of interest in his laboratory-like practices. A survey of exhibition titles reads less like art exhibits and more like research projects: Color in Transparency (Berlin, 2006), An Education of the Senses (Chicago, 2010) and The Art of Light (Madrid, Berlin, The Hague, 2010–2011). Others tune into the more visionary aspects of his work; titles such as Sensing the Future (Winnipeg, Berlin, 2014), The Shape of Things to Come (Santa Barbara, 2015) and Future Present (New York, 2016) allude to a time-traveling aspect of his work. Indeed, the recently recognized “seer” of the future held a lifelong fascination with light: he believed in “tele-projection” [2], in which light displays would be controlled and broadcast over great distances, and “photo-telegraphy” [3], whereby illustrations would be instantaneously reproduced. Almost from the start, he wanted to “paint” with light and use “beams of color” as a medium. Moholy forecasted the installation of “light frescoes,” in which colored lights would fall onto treated walls, visually transforming the space into ephemeral symphonies of vibrating ether [4]. Ultimately, it was light that led Moholy to push the boundaries of art and explore the dynamic realm of “time-spatial energy” [5].

Throughout his career, Moholy was deeply invested in Albert Einstein’s theory of relativity; the physicist’s theories of space, time and energy permeate Moholy’s writing and approach to artistic practice [6]. As Linda Dalrymple Henderson succinctly puts it: “For Moholy, Relative Theory was emblematic of a fundamental shift toward a more dynamic world view to which artists must respond by replacing the static methods of the past with an art of motion and time.”
Henderson astutely argues that Moholy remained profoundly committed to “Einstein and the world of space-time” [7]. Such commitment, however, was always more than either a limited appropriation of a scientific theorem or a singular application of a disciplinary perspective. In his writing, Moholy referenced the complexity of dimensional understanding, from classical representations and topographical models to modern non-Euclidean geometries and n-dimensional formulations of space and, more esoterically, from etheric energies to bodily vitalities [8]. Space-time, he instructs, “stands for many things: relativity of motion and its measurement, integration, simultaneous grasp of the inside and outside, revelation of the structure instead of the façade. It also stands for a new vision concerning materials, energies, tensions, and their social implications” [9]. A deeper survey reveals that the intellectual complexity that energized his work also motivated an extensive regeneration of his ideas in a variety of past and current artists’ homages.

Moholy’s scientific inquiries are directly imprinted in the “spatio-” “lumino-” and “chrono-dynamic” kinetic installations of Nicolas Schöffer, progenitor of cybernetic art—many consider his 1956 CYSF-1 the first cybernetic sculpture. They resonate in the British Independent Group’s interest in bioforms [10] and tunnel through the Institute of Design in Chicago, which began as the New Bauhaus in 1937, after Moholy left Germany for Britain and subsequently immigrated to the United States. As the Chicago school’s first director, Moholy established an organic or naturally integrated laboratory approach [11], the lessons of which continue to reverberate in Chicago-based artists’ tributes: For example, in 2012, Jan Tichy produced a three-channel digital video Things to Come 1936–2012 (2012), reclaiming Moholy’s special-effects footage cut from William Cameron Menzies’ 1936 film, based on H.G. Wells’ novel; and in 2011 Eduardo Kac realized Aromapoetry (2011), referencing Moholy’s suggestion to incorporate all the senses, including smell, into art [12]. Moholy’s influence is discernible in new media artists’ installations, from Dan Graham’s to Bill Viola’s, additionally, Brit- ham’s to Doctor Who. Like the Doctor’s TARDIS, Moholy’s L-SM opens a space-time bridge, connecting past, present and future; significantly, like the apparatus in the BBC series, L-SM also, at least in its first incarnation, was housed in a dimensionally transformative box.

**MOHOLY’S PIVOTAL LIGHT-SPACE EXPERIMENT**

For the Deutscher Werkbund exhibition in Paris (1930), which was its initial installation and only public display in his lifetime [19], Moholy may have conceived L-SM as a stage prop [20], although in some passages he also describes it as a “prototype,” “model” and even “piece of lighting equipment.” In any case, he designed the device to sit inside a cubelike box, 120 cm (about 47 inches) in each dimension. The encapsulating structure was to have a circular opening (“stage aperture”) in front, rimmed with colored lights. In his writing, Moholy specified yellow, blue and red lights, as relativity, radioactivity, atomic structure, electromagnetic waves (microwaves, infrared radiation, visible light and X-rays) and photonic particles. He was also captivated by new communication media, which in his day included the telephone, telegraph, television, electric (artificial) light and cinema. Moholy found these developments exhilarating and sought to embody the emerging reconceptualization of space-time in his work, less as scientific illustration than as provocative experiential manifestation. His “kaleidoscopic” “mobile”—or as he variously called the device, Light Display Machine, Light Prop or Light-Space Modulator for an Electric Stage—which after his death inexplicably became known as Light-Space Modulator (for brevity, I use L-SM), was the vehicle through which he most extensively investigated the sensual remapping of space-time. Designed with the help of engineer István Sebők and technician Otto Ball, L-SM was less a sculptural work than a multisegmented, variously rotating “experimental device” [18] through which the artist explored simultaneity, interpenetration, perforation and spin, invoking transdimensional space and time-space entanglement. To demonstrate the playfulness within Moholy’s L-SM, it is necessary to take an imaginative leap and bring in a fictitious space-time and higher-dimension (or fourth-dimensional) traveler—Doctor Who. Like the Doctor’s TARDIS, Moholy’s L-SM opens a space-time bridge, connecting past, present and future; significantly, like the apparatus in the BBC series, L-SM also, at least in its first incarnation, was housed in a dimensionally transformative box.

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removed, so that light and shadows would project on a variably sized screen placed behind the box. The device’s static and rotating components, however, figure more prominently in Moholy’s description. Indeed, the fact that Moholy fought for years to realize the piece and then continued to tinker with the physical mechanism throughout his lifetime (a major retrofitting occurred in 1970 and, since then, three replicas have been produced) suggest that the kinetic elements had a profound influence on his practice and conceptual thinking [23].

In “Light-Space Modulator for an Electric Stage,” Moholy states that the main part of the device consists of a “three-sectioned frame,” which resembles an upright three-paddled beater-bar mechanism commonly used in industrial applications such as paint mixing (Fig. 1). At its base, the bottom “arms” of the three-paddle assembly are tightly secured to a circular platform, and its central rod penetrates the platform’s vertex, slotted into the motor-driven crankshaft system below. Once switched on, the motor spins the central circular platform and the connected three-paddle bar assembly in a clockwise motion. Each paddle-bar, however, also acts as a divider; its radial arms split the circular space into three equal sectors.

In “Segment A” [24], the artist clamps a large perforated disc to one arm of the beater-bar frames. He also secures the disc to the midsection of a metal tine, which extends from the beater-bar’s central rod outward. The radial prong also hooks onto two additional components: a smaller perforated disc and a rectangular, slightly convex wire enclosure. In contrast to the larger disc, the smaller disc attaches to a two-rod-assembly, which extends below the platform and connects to a secondary gear system. As the main platform rotates, the two-rod-assembly pumps the smaller-diameter disc up and down in a piston-like fashion. Because the disc-rod assembly also connects to one side of the wire enclosure, as the smaller disc rises and falls, it pushes the cell. The trapped wooden ball, sitting in the enclosure, slides diagonally from side to side. Or, as Moholy writes, the ball flips between the two discs in its “loop.”

In the sector designated “Segment C,” a metal corkscrew (originally glass) penetrates a wedge-shaped Plexiglas plate (initially a type of cellulose or glass), which is tilted slightly downward. While the tip of the corkscrew is untethered, it is welded to a small shiny metal disc at its base. The base is then connected to a support rod (which, in its current incarnation, is bent for smoother rotation) and, as in the previous sector, links to a secondary gear (or cam) system below the platform. Here, however, as the central stage moves clockwise, the corkscrew-wand assembly rotates counterclockwise.

Of the sectors, the third, or “Segment B,” is the most complex and has probably changed most in subsequent retrofits. In this sector, a stabilizing radial tine extends out from the central shaft and attaches to a secondary support pole. The secondary pole passes through a series of discs and wedges before slotting into the lower rotational drive system. Two discs and two wedges support a smaller three-paddle system, the individual components of which Moholy referred to as “flags.” In the restored and updated version, the upper and lower staffs of each flag are secured into a radial slot and attached to a spring-and-coil mechanism, enabling them to slide in and out as the platform rotates (Moholy had originally instructed that they rock “on an endless path”). Like the corkscrew, as the flag-assembly moves in and out, it also rotates counterclockwise. Today, the flags, like the paddles, are adorned with various types of surfaces: a fine metal grid, a coarse metal grid, and a sequence of bent wires, on the smaller; a string of metal staffs, a Plexiglas plate and an open frame, on the larger.

For almost ten years Moholy “battled” for L-SM’s realization. Although he “knew by heart” what all the effects would be, when he put the device in motion for the first time, its light-space modulations were “startling.” As the device rotated, light “thrown on its transparent and perforated screens” resulted in surprising sequences of lights and shadows. As the highly polished nickel- and chromium-plated surfaces rotated, they “looked like transparent sheets,” and he called the projections “new visual effects, a kind of interpretation in fluid change.” Captivated, he felt like a “sorcerer’s apprentice”—he declared, of that moment: “I almost believed in magic” [25].

Testament to the kinetic device’s lasting importance resides in the fact that Moholy always kept L-SM close at hand, lugging it in an almost Herculean fashion as he peripatetically wandered Europe and immigrated to America. Further proof of its pivotal role resides in his comment that L-SM was
a visual experiment out of which his later paintings, photographs, photographs, films and industrial designs emanated. Even if the work (which today is perhaps his most known) was rarely displayed and, at least until 1970, only shown as a static sculpture, its limited display history is beside the point. Moholy used L-SM as a “picturing” experiment or framing apparatus through which he reoriented his vision to modern technological advances and “the forces that give shape to the elements of the world” [26]. The kinetic sculpture’s “magic” signaled Moholy’s attempts to visualize dynamic forces hidden within the physical realm—not to control or verify but to engage a host of energy fluctuations and surface tensions, however unstable or ephemeral they might be. In his laboratory-like, self-learning practice, the apparatus helped him conceptualize a new vision and/or vision in motion. Like the TARDIS, which fictionally travels through time and space, the magic of L-SM’s modulation tunnels through Moholy’s teaching, paintings, photographs and films, and can only be fully grasped when one becomes attuned to its multiple thresholds—the “simultaneous penetration of inside and outside” [27]—or, in Doctor Who’s words, its “transdimensional engineering.”

MOHOLY AND TRANSDIMENSIONAL ENGINEERING

Although to some degree his idea of “New Vision” relates to Picasso’s and Braque’s cubistic experimentation with interpenetration, in which they represented multiple views of objects, from above and below, left and right sides and in cross-section [28], Moholy’s concept, as Ruth E. Iskin suggests, concerns a more radical interpenetration between “extreme nearness” and “great distances” [29]—a notion innovatively explained in a 1977 episode of the British sci-fi series Doctor Who, “Robots of Death.”

The specific scene opens with the fourth Doctor (Tom Baker) and his assistant Leela (Louise Jameson) in the TARDIS; Leela is spinning a yo-yo and the Doctor is working at the console. Under the impression that her toy was a gravitational up-down force and rotational movement had something to do with the magic of the TARDIS, Leela asks the Doctor if she can stop throwing her yo-yo. When the Doctor informs her that the yo-yo’s motions have nothing to do with the TARDIS, Leela hotly replies: “You said I had to keep it going up and down. I thought it was part of the magic.” Surprised by her assumption that the TARDIS relies on “magical” forces, the Doctor matter-of-factly responds that nothing, including the forces that propel the TARDIS, is “inexplicable.” Leela then asks why the TARDIS is larger on the inside than the outside. “It’s because [its] insides and outsides are not,” he discloses, “in the same dimension”; demonstrating the concept, he holds two different-sized boxes in his hands and asks Leela which is larger. She of course selects the larger-dimensioned box. He then places the larger box on the console, and walks to where Leela is standing. With the smaller box in hand, he re-asks the question. Pointing to the larger box on the console, she logically deduces “that one.” “But [from here],” the Doctor counters, “it looks smaller.” “Well,” she responds, “that’s because it’s further away.” “Ex-
the artist’s deep interest in space travel [35]. Likewise, the spiral sector in Moholy’s research apparatus (also in many of his 1920s photographs, photograms, 3D sculptures and series of conceptual architectural sketches for his “Kinetic-Constructive System”) links his work to early avant-garde explorations into higher or fourth dimensional space—decidedly, however, with a twist.

In contrast to Duchamp’s 2D pattern generating a 3D virtual space, which he attempted to further in his experiments with stereoscopic imagery [36], Moholy uses a rotating 3D spiral, flipping not forward and back on a vertical plane but spinning on a slightly tipped horizontal axis. As the physical shaft of the corkscrew rotates, its metal auger or worm cuts through, modulating, or ordering, space. Drawing attention to negative space, the rotation (though hesitant or throbbing in the actual device) radially articulates a virtual conical volume. Provocatively, the form invokes a “worm” hole (which Einstein and Nathan Rosen predicted in 1936); it either bores through the emptiness of relative space, cutting into a higher (outer) dimensional realm, or becomes part of an elemental system, invoking an arena of invisible forces and energy fluctuations.

In L-SM, the spiral is part of a bidirectional spinning, up- and-down thrusting mechanical apparatus. As the main platform spins clockwise, two of the ancillary components—the corkscrew sector and the smaller paddle or flag array—spin counterclockwise. (In some schematics, the flags were meant to rotate in the same direction as the main platform; however, at some point in the realization of the sector-component, their rotational direction was changed.) Together the movements suggest a “fluctuating play of [opposing] forces” [37]; this description undoubtedly refers to Raoul Heinrich Francé’s theories of biotechnics, self-generating processes and optimization of forces found in nature [38] and the canceling effects of attractive-and-repulsive electromagnetic forces. The spinning and pumping movements also invoke the coiling and thrusting elements used in electrical components, through which electromagnetic fields are modulated and magnetic fields transformed into electromagnetic energy.

Modulation and transformation are central to Moholy’s entire practice: 3D forms, photographs, films and paintings. They are also integral to his writing. In many passages, Moholy invokes the omnipresent tension of bidirectional, or clockwise and counterclockwise flow, for example: “Openings and boundaries, perforations and moving surfaces, carry the periphery to the center, and push the center outward.” Believing deeply in an advocacy relationship of humans to elemental forces, a sensory attraction to radiant energy flows and an experiential connection to technological systems, Moholy suggests that “a constant fluctuation, sideways and upward, radiating, all-sided, announces that man has taken possession, so far as his human capacities and conceptions allow, of imponderable, invisible, and yet omnipresent space” [39]. In effect, L-SM visualizes centripetal self-generating forces, which returns us to the TARDIS.

In the 1963 premiere episode of Doctor Who, the main character pulls levers and turns dials, activating for the first time the TARDIS’s space-time capabilities. As the floor shakes and machine “wails” (though updated, the sound effect is still associated with the box’s space-time travel), a British-Pop-Art/Moholy-inspired Plexiglas modulator emerges from the central console (Fig. 2). As the TARDIS takes off, the console-modulator pumps up and down and spins, as if producing its own electromagnetic-subatomic energy. A monitor, above the door, shows London rapidly disappearing beneath the police-box-shaped ship. In a reverse shot, the lift off resembles a rocket launch speeding into space. The vaporous plume invokes an actual rocket launch but quickly transforms into a beam of light. As the TARDIS dematerializes, the beam fractures into blobs of floating light. The amorphous radiating shapes begin to curve and elongate, forming a giant cosmic spiral—simultaneously invoking galaxies and propulsion forces within those galaxies. As the spiral turns or worms, the TARDIS transports its occupants across space and time, through transdimensional flux, landing in a prehistoric landscape.

Moholy’s invention does not travel through time. Yet its allusions to elemental forces and projective spaces suggest that in some ways it does. Like an exploding nova, L-SM beams its message into space-time. We see its spiraling constellations, which, according to Einsteinian theory, when exploded, become cosmic light telescopes that warp time into galactic pasts and futures [40]. Once illuminated, L-SM’s “message in a bottle” is not one but multiple messages, all of which can appear simultaneously or in various space-times. It manifests as a box, sculptural object, apparatus and, most definitively, protracted light-space modulator—from which emerged his later painting, photography, motion pictures, architectural
projects and industrial designs—in short, the creative magic that continues to inspire artists today.

L-SM was always Moholy’s most concentrated engagement, in which he most fully realized his desire to explore light as a medium. It remains his most effective frame whereby he investigated the elemental forces within our physical world and transdimensional flux. As the device’s thrusting-twirling-spinning motion transforms into a dynamic radial, projective fluidity, L-SM seems to power itself; its illuminated movements capture and extend extraordinary dimensions. Like the TARDIS, Moholy’s L-SM warps space-time: After watching Light Display, Black White and Grey (1931), his film based on L-SM, Moholy felt time dilate and stretch out [41].

In the end, it is less important that Moholy embraced Einstein’s theory over Hinton’s concept of a fourth dimension. What is more interesting is that the theory of space-time has undergone a sea change and moves toward Moholy’s. In “The Origins of Space and Time,” Zeeya Mebali argues that in the new theory of space-time, general relativity and quantum mechanics are intertwined with thermodynamics. Such a revision of Einstein’s theory, she argues, “suggests that gravity on a macroscopic scale is just an average of the behavior of some still-unknown ‘atoms’ of space-time.” The universe may be a “network of intersecting quantum threads, each of which carries quantum information” and is “held together by quantum entanglement on the boundary—which means that in some sense quantum entanglement and space-time are the same thing” [42]. Viewed from such a lens, the magic or spookiness Moholy saw all those years ago turns upon such a nascent notion of entanglement. As L-SM oscillates and its lights flicker, space-time and light compress and stretch, and light-time-space become entangled; in the process, the jiggling, unstable modulating-apparatus changes how we perceive his art. We simultaneously see the apparatus and its thermodynamic projection; the light projection and the kinetic movement become intertwined.

References and Notes
6 Moholy directly cites Einstein’s theory of relativity in Vision in Motion (Chicago: Paul Theobald and Company, 1966) p. 266.
17 Rawsthorn [13].
21 Moholy most extensively describes the piece in “Light-Space Modulator for an Electric Stage” [2] pp. 310–311. Unless noted, all subsequent citations are from the essay.
22 For further discussion and original diagrams, see Botar [18] pp. 114–127.
24 See the working schematic included in Botar [18] p. 121.
26 “Manifesto of Elemental Art” [1].


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