

Detail. Frederick Kiesler.
Biotechnical motion study.
Figure from "On Correalism
and Biotechnique,"
Architectural Record, 1939.

Toward a Research Practice: Frederick Kiesler's Design-Correlation Laboratory

STEPHEN PHILLIPS

Design research laboratories are ubiquitous in schools of architecture today. We have become a research culture committed to endless forms of observation, speculation, experimentation, and production. Research, however, has not always been prevalent in design culture, and it was not until the mid-twentieth century that Austrian-American architect Frederick Kiesler (1890–1965) formed one of the first scientifically based design research laboratories in a school of architecture within the United States. Initiated during the Great Depression when little work was available to architects, Kiesler invented a new paradigm of design research and its education to support ingenuity relevant to meeting the changing needs of an evolving design profession. Faced with similar crises in the economy and building industry today, a reappraisal of research traditions as they impact contemporary culture seems particularly relevant. Kiesler's design research laboratory, with its unique pedagogical ambition, which he widely professed by the 1940s, proves exemplary in this capacity.

Design Education

“Architectural education's primary purpose is to teach students to think for themselves,” Kiesler declared at the Conference on Coordination in Design held at the University of Michigan, March 8, 1940.¹ Kiesler's pedagogical statement was met with stunned silence in the room. He was suggesting a radical departure from the opinions held by his colleagues Walter Gropius, László Moholy-Nagy, and Eero Saarinen, who strongly favored teaching manual training, material knowledge, and universal principals of design. Kiesler instead supported educating students with a broad scientific approach to problems through innovative laboratory research that might generate new modes of independent and creative thinking. Not interested to teach students acritical design methodologies that merely supported static standards and accepted ideals, Kiesler even had the temerity to suggest that architecture students avoid copying modern European architecture as fervently as modernists had insisted that they avoid copying historical styles. Mesmerized by Kiesler's propo-

sition, the conference committee—which comprised Wells Bennett, dean of the College of Architecture and Design at the University of Michigan; Joseph Hudnut, dean of Harvard’s Graduate School of Design; and Walter Baermann, director of the California Graduate School of Design at Caltech—unanimously adopted Kiesler’s vision as a promising new direction for architectural and industrial design education.

The conference committee had organized the meeting in Ann Arbor as a serious attempt to establish a fundamental educational background for architects and industrial designers in the United States. Prior to the 1930s, American architects typically received formal education through Beaux-Arts training in universities, a combination of theory and practice in polytechnic institutions, or through the fine arts in academies. With the influx of European émigrés to America during the Second World War, architecture education evolved to incorporate broad curriculums that coordinated technology and theory, fine and applied arts, and building crafts into complex fields of knowledge. Modern European approaches to architecture education, most notably those formed under Walter Gropius at the Bauhaus, took hold of the most prestigious institutions in the United States. The Ann Arbor conference served as a sounding board for the most prominent proponents of modern design pedagogy.

Although Kiesler was a marginal figure in education at the time, his emphasis on architectural intelligence, process, and research methods over the training of rote skills, techniques, and autonomic procedures carried enormous value. Leopold Arnaud, dean of the Columbia University School of Architecture, invited Kiesler to participate at the Ann Arbor conference because of Kiesler’s innovative teaching methods. As a visiting professor at Columbia since 1936, Kiesler had avoided the meaningless production of repetitive simulacra typically generated in architecture schools by adapting the studio environment into an intensive research laboratory.

Employing a multidisciplinary approach in what he titled his Laboratory of Design-Correlation, Kiesler expanded the role of architectural education to include diverse fields of knowledge. Kiesler and his students engaged historic, theoretic, and technical investigations to formulate design variation. They researched and examined case studies, read philosophic and scientific texts, analyzed planning relationships, and built working prototypes. Through diverse and intensive explorations, Kiesler challenged his students to develop innovative organizational strategies and research procedures to invent and test new modularized systems for mass production.

In his laboratory, Kiesler organized assignments and lectures to examine how architecture could affect spatial perception and coordinate everyday

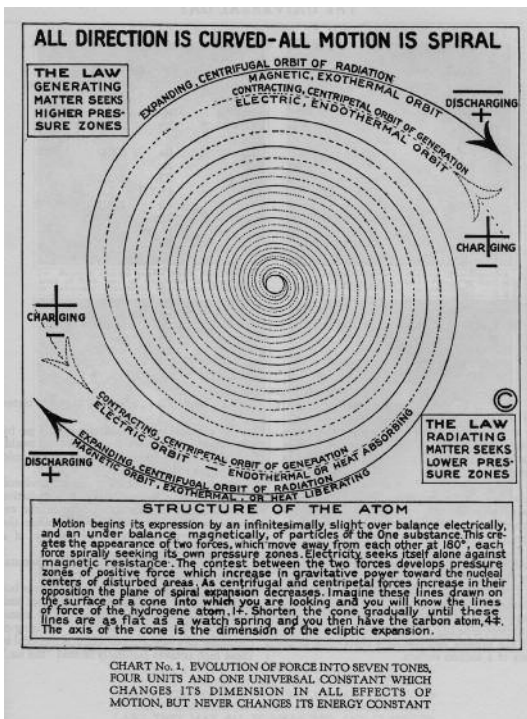
habits through vision and touch. Students studied late-nineteenth- and early-twentieth-century uses of the time-motion study and applied their research to formulate design methodologies that incorporated changing and varied psychological and physiological parameters. The laboratory invented new ways to modulate the built environment in response to multiple spatial habits of perceiving bodies in motion as situated and evolving through time. Their forms were designed to be “elastic”—mobile and flexible—able to expand and contract to perform multiple dwelling tasks. Kiesler’s laboratory was at the forefront of a design research culture interested in harnessing human perception and behavior in order to facilitate new and evolving systems of capital production and proves an important precedent to educational models interested in the study of mass behavior, visual and corporeal affect, responsive systems, and relational organic structures.

Theater Laboratory

Kiesler’s experience as a teacher began in New York City in 1926 as a stage design instructor. Upon traveling to the United States to present new European avant-garde theater to an American audience at the International Theatre Exposition in New York City, Kiesler formed the Brooklyn International Theater Arts Institute with associates Princess Norina Matchabelli (aka Maria Carmi) and Dr. Bess Mensendieck. Together they built “a laboratory of the modern stage” by organizing the school into three departments—one psychological, one scientific, and the other artistic.² Although Kiesler was affiliated with the institute for only a short time, it proved to have an enormous impact on his developing pedagogy.

To teach students to control their outward expressions, Matchabelli contributed theories on psychoanalysis and autosuggestion to the institute’s acting program. She believed acting to be an art of “co-relation”

between the brain, soul, and body modeled through an art of training where “inborn unconscious talent” can be studied and enacted “consciously.”³ The body’s ability to express affectations was a common theme explored in her courses. As they worked together, Matchabelli provided Kiesler with extensive reading material in the fields of psychology and perception, in addition to texts on electricity, magnetism, cyclical theory, space-time, and continuity by Walter Russell, Einstein, and others.⁴ Contracting and expanding universal principles of degenerative and regenerative



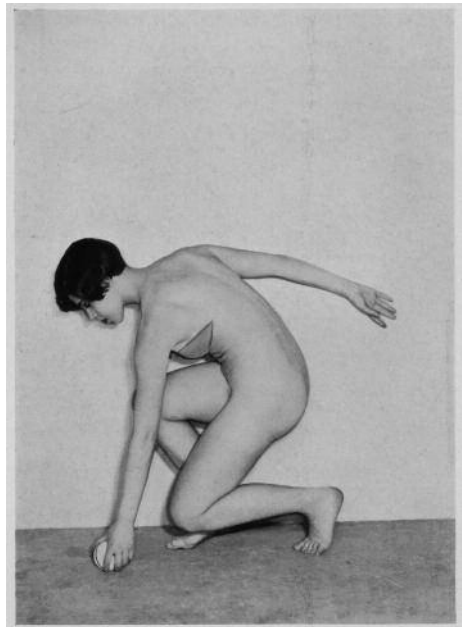
“All Direction is Curved—All Motion is Spiral.” Figure from Walter Russell, *The Russell Genero-Radiative Concept or the Cyclic Theory of Continuous Motion*.

energy forces—balancing in dramatic states of comfort and discomfort—became powerful themes Kiesler would develop along the lines of similar work by Mensendieck.

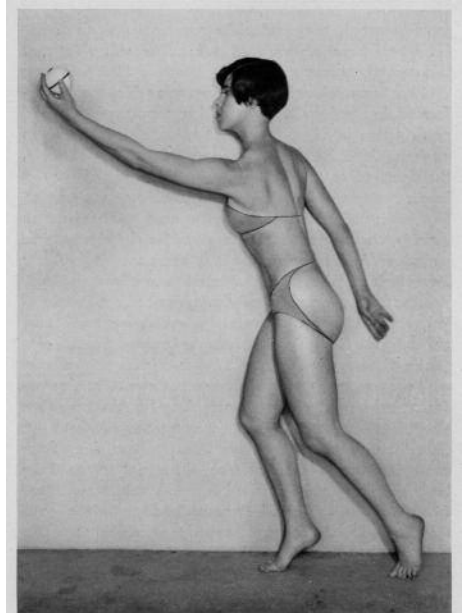
As an American who had studied sculpture in Paris and medicine in Zurich to become “a sculptor of human flesh,” Mensendieck was a leading authority on scientific physical culture related to human anatomy, biology, rhythm, motion, and dance.⁵ Her research, which she taught daily at the institute, aimed to revitalize the human body by combating faulty habits and retraining body structure to perform intelligent gestures and graceful movements. “In order to express the innate unconscious talent consciously,” she explained, students were taught to analyze the moving body in order to determine how to best express themselves autonomically.⁶ In observing that “Control of the Delineation and Extent of Movement in Space” created “beauty of contour” and “economy of energy” in everyday gestures, Mensendieck showed her students through training and exercise how to optimize their body actions.⁷ Her work focused on the “elastic” capacity of joints and muscles to flow in what she called “physiologic rhythm.”⁸

The twentieth century marked an obsessive curiosity with the habits of human performance, which the Brooklyn Theater Institute was interested to investigate. From the study of quantifiable actions to the analysis of qualitative conditions, scientific inquiry into human perceptions, thoughts, feelings, and actions guided their modern views. No longer characterized by a form of classical stasis, human bodies were studied for their capacity to coexist as organisms within an evolving field. The Brooklyn institute researched the mind and body’s elastic capacities to adapt to changing environmental conditions. Kiesler later translated the results of this research to stage design.

Kiesler taught artistic stage practices at the institute from 1926 to 1927 and continued to lecture at other arts and theater institutions in New York over the next few years until he accepted a permanent position as manager and scenic director at the Juilliard School of Music, where he worked from 1934 to 1957. At Juilliard, Kiesler produced his first biomorphic



ILL. 25.—The right technique in stooping results in a position which is the mechanically correct one from which to start the rising movement. When the foot-forward position is used for stooping, the greatest possible amount of elasticity for the upward movement will be secured. A right automatism ensures unbroken Physiological Rhythm in the act itself, as well as readiness for continued movement.



ILL. 26.—The elasticity made available through a correct stooping position (Ill. 25) entered advantageously into the rhythmical rising motion which resulted in this perfect distribution of the masses in space. If movements in sport are based upon automatons that conform with those laws of mechanics which govern muscle function, the architectural structure of the body will not be impaired.

Right: Nickolas Muray. Figure demonstrating physiological rhythm. From Bess M. Mensendieck, *It's Up to You*. Photo © Nickolas Muray Photo Archives.

Opposite: Frederick Kiesler. *Helen Retires*, 1934. Photograph of stage and costume designs. Courtesy Kiesler Archive, Vienna.

design—the opera sets for *Helen Retires* by George Antheil and John Erskine in 1934. Kiesler’s design consisted of a series of plywood shields in forms shaped to the body movements of actors playing the ghosts of dead war heroes. Helen moved about the heroes dressed in black with reflective lines and points on her arms, joints, and legs similar to those used by Étienne-Jules Marey in his chronophotography studies. Kiesler explored the artistic potential of Marey’s experiments. Through time-motion study of human movement, gesture, and rhythm, Kiesler began to stylize his stage designs using shapes characterized by human forms.

For Kiesler, correlating costumes and stage scenery to the organic rhythms of bodies-in-motion supported the study of architecture as it had earlier for Oskar Schlemmer and Moholy-Nagy at the Bauhaus. As Kiesler would later suggest in *Architectural Forum*, stage design responds to performative criteria that evolve throughout the drama of the play.⁹ Theater is not a static proposal, and theater architecture as Kiesler imagined it did not aim to be permanent or fixed. For him, a stage was designed according to the rhythms and movements of actor and spectator. In his 1935 design at the Metropolitan Opera for *In the Pasha’s Garden* by John Seymour and Henry Tracy, for instance, Kiesler created a spiral platform similar to his 1924 Space Stage to stimulate actors to encircle space fluidly, almost automatically, along a spiral incline. Kiesler’s ambition to create environments that motivate human actions informed his theater constructions, and throughout his career he sought opportunities to experiment with architecture that would respond to performative events.

Valued highly in educational circles in New York at the time, Arnaud invited Kiesler to collaborate on a new course in scenic design at Columbia’s School of Architecture that was instituted in the fall of 1936. Kiesler directed his students to plan and construct the sets and costumes used for two of the operatic performances produced at Juilliard that year. His course was well received, and he not only continued to teach stage design at Columbia but was also invited to launch his Laboratory of Design-Correlation.



The Laboratory of Design-Correlation

The Laboratory of Design-Correlation was created for the systematic study of pure form and its application to architecture and industry. The laboratory was part of a larger programmatic experiment at Columbia initiated to investigate a scientific approach to architecture design and urban planning. Devised for experimentation in practical systems of construction technique, the laboratory served as an alternative course of study to the core graduate architecture studio design curriculum—leading to a master of science in architecture degree.¹⁰

The course was multidisciplinary in nature and open to candidates throughout the university. In the first year of the laboratory, Kiesler selected one student from the School of Architecture and enlisted three other students outside the department: one from industrial design, one from art, and the other from sociology. Kiesler divided the laboratory into theory lectures, research techniques, graphic presentation methods, model planning, and shop work. Alongside his lectures, he presented films from physics, anthropology, and biology and taught a supplemental weekly two-hour graduate elective architecture seminar, titled “Morphology of Design,” on the interrelationship of form, function, and structure in nature and shelter construction. Studies presented on the evolution of form and function both in nature and technology were then structured around a practical laboratory experiment.¹¹

In his “First Report on the Laboratory for Design Correlation” to Arnaud, Kiesler explained that he had introduced the practical problem of storing books in the home to the studio:

I chose . . . [this] theme because everyone is familiar with it, and by that have probably lost perspective of it. One of the chief aims of our Laboratory is to learn to see everyday happenings with a fresh keen eye and to develop by that a more and more critical sense for our environment.¹²

Critical study of everyday life was important, and by challenging perceptions of daily habits Kiesler hoped to gain new insights into designs for familiar activities. He proposed to study “Biotechnique,” the dialectical relationship between a human being and the environment, or, as he described it, “the interrelation of a body to its environment: spiritual, physical, social [and] mechanical.”¹³

Biotechnique/Biotechnic

Although Kiesler used the term *biotechnic* in his preliminary proposal for “A Laboratory for Social Architecture” while lecturing in Chicago on industrial design in 1933, by 1934 he had switched to using the term

biotechnique.¹⁴ “*Biotechnics*, a term which Sir Patric[k] Geddes ha[d] . . . employed,” Kiesler argued, “can be used only in speaking of *nature’s* method of building, not of *man’s*.” Biotechnique, he emphasized, “*is the special skill of man which he has developed to influence life in a desired direction.*”¹⁵ Biotechnique was, for Kiesler, a method or strategy to create form that was different from the notion of “biotechnic” employed by other authors at the time.

For example, architecture historian Lewis Mumford had begun using the term *biotechnic* in his 1934 *Technics and Civilization*, in which he defined the “biotechnic” as a period of architecture when machines would completely integrate with human needs and desires. For Mumford, the biotechnic described a future period of unity between society, morality, and the machine, where through close observation, analysis, and abstraction of nature—architects, and planners would study the environment to assimilate bodies and machines in the hope to create “a new conception of the organic” as an economic “collective.”¹⁶ The biotechnic period, according to Mumford, alluded to a complex state of automatism that he believed would best support a Communist lifestyle by eliminating social distinctions and providing more leisure time for the masses. Although Kiesler’ and Mumford’s overall strategy in creating an ecologically informed architecture was similar, Kiesler’s interest in “biotechnique”—as a systematic environmental design methodology—more closely resonated with Hungarian plant biologist Raoul H. Francé’s 1920s “biotechnic” proposal.

As described in Francé’s *Die Pflanze als Erfinder*, a biotechnic design approach examined the technical arrangements of unicellular organisms and other artistic forms in nature in order to manufacture economic constructions. To design a new medicinal shaker for example, Francé observed how the elastic holes of a poppy plant expanded or contracted in the presence of humidity or dry air to release spores.¹⁷ These natural material processes among others inspired his writings on design, which proved to have enormous impact on the members of *G* magazine, especially Moholy-Nagy, Ludwig Mies van der Rohe, and, at least indirectly, Kiesler, who had joined the group as an associate and editor in 1926.¹⁸ Francé’s biotechnic approach to growth and structure in plants (*biotechnischen*) provided members of *G* an environmentally sensitive model for synthetic design practices. In 1928, Moholy-Nagy, referring to Francé’s writings, coined the term *biotechnique* to describe a formal methodology that specifically applied seven basic elements—the crystal, sphere, cone, plate, strip, rod, and spiral—to shape all forms of industrial and building design.¹⁹ Kiesler later developed biotechnique as a complex environmental design practice, one that he elaborated for housing design and

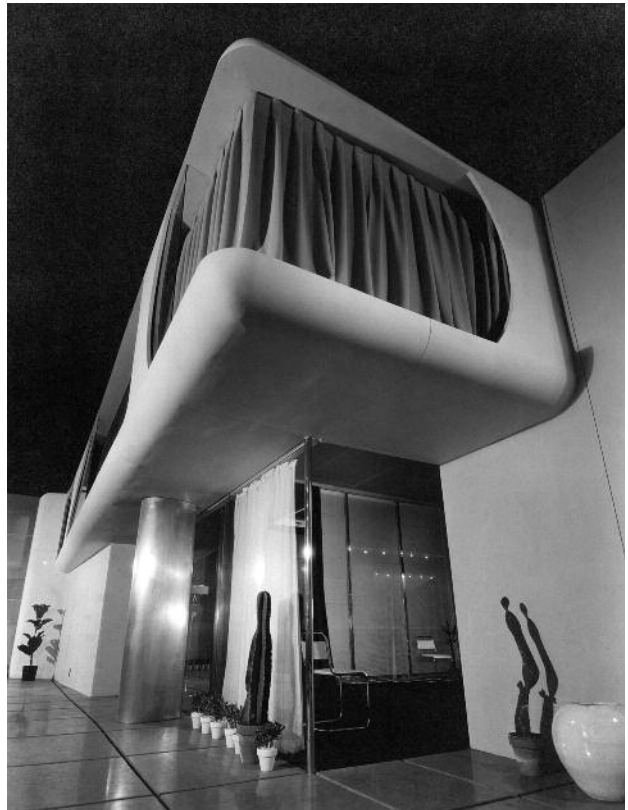
first published in *Hounds and Horn* magazine in March 1934 to annotate his Space House building project.

The Space House

Kiesler's Space House was one of his few architecture projects ever constructed and the only house he built; it incorporated his biotechnical strategies by creatively correlating moving bodies with performative building systems. Kiesler designed the Space House—which was constructed in 1933 as a way of attracting visitors to the Modernage Furniture Company's headquarters on East Thirty-third Street in New York City—to respond to changing habits and user needs.²⁰ With push-button roll-down doorways, flexible sponge rubber carpets, rollaway curtains, and sliding partitions, the Space House created a variety of mobile and flexible environments. As described by Kiesler in a series of unpublished sketches and notes, the Space House “contracted” to provide seclusion for a single individual or “expanded” to support group interactions. The house was not intended to be fixed in time but to be keyed to the changing and evolving requirements of its habitants. Kiesler's design for the Space House sought to envelop dwelling within architecture geared to the changing interactions of work, rest, or play. Its form was intended to take shape in correlation with everyday use: the house would move with seamless organic expression in response to the body. “Stream-lining becomes here an organic force,” Kiesler asserted, “as it relates the dynamic equilibrium of body-motion within encompassed space.”²¹ The “proprio-spatial dynamic” function of the house, he argued, was its ability to seam complex components into one continuous “elastic” construction. The house provided a variety of spaces that correlated multiple shifting human actions within a unified structure. Correlation of bodies and their surroundings became the central principal of Kiesler's design, which in turn formed the basis of his innovative doctrine of “correalism.”

Correalism/Correlation

Kiesler most likely derived his use of the term *correlation* from theories of plant and animal morphology described by Geddes in his 1911 book *Evolution*. Geddes's chapter on “Variation and Heredity” examined the history and theory of correlation, as originally stud-

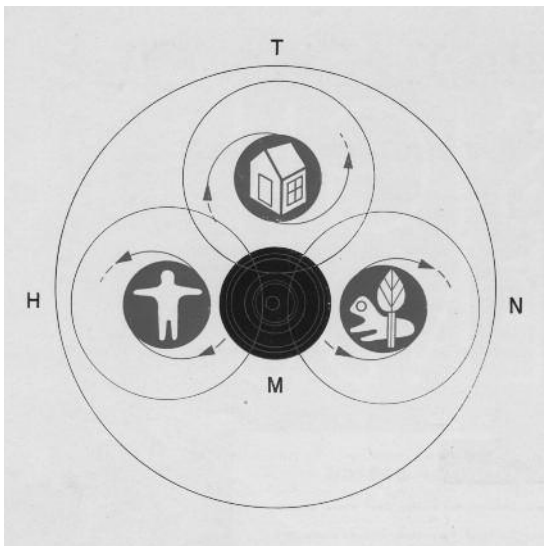
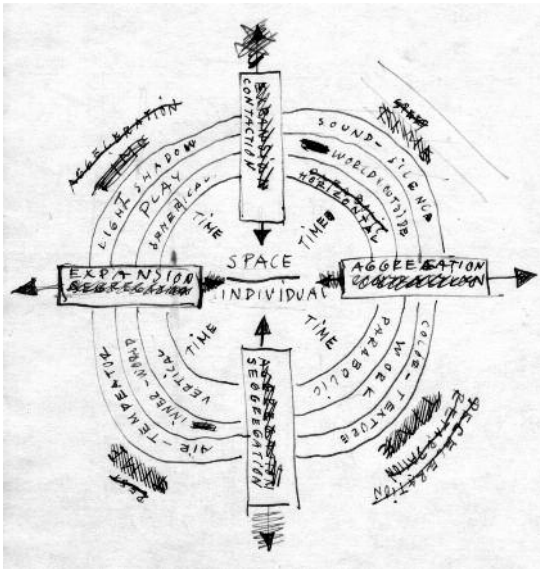


Frederick Kiesler. Space House, 1933. Photograph of prototype. Courtesy Kiesler Archive, Vienna.

ied by E.S. Russell in his formative work *Form and Function*.²² Kiesler held a copy of *Evolution* in his library and later had his students transcribe *Form and Function* in the Design-Correlation Laboratory. Similar to Russell, Kiesler used *correlation* to describe the practical application of structural form to bodily function where the aggregate whole is constructed in relation to its parts. Correlation became a significant topic in architecture in the 1930s after Buckminster Fuller titled his introduction to an issue of *Shelter* magazine “Correlation” in 1932.²³ For Fuller, the idea of correlation best described the interconnection, continuity, and interrelationship between the working practices and discourses of the Structural Studies Associates (SSA), which included Kiesler as a member of their group. Kiesler elaborated the study of correlation to apply to architecture in its relationship to human bodies and the environment.

Correalism was Kiesler’s neologism for *correlation*.²⁴ According to Kiesler, correalism provided a scientific basis for architects to construct viable technological environments and applied to all possible design

products, from “shirts to shelter,” that could become the “constituent parts of . . . [our] total environment.” Correlation between nature, bodies, and the built environment, Kiesler believed, could be modeled on the laws of molecular interrelationships that interact between natural and manufactured organisms and systems, where reality and forms were merely “visible trading posts” of continuously mutating “anabolic and catabolic,” “nuclear-multiple-force[s],” “integrating and disintegrating . . . at low rates of speed.”²⁵ Any distinctions between subjects and objects were understood to be diffuse products of the constant exchange of molecular forces acting in time. Time thereby was essential to correalist practice, because “time,” Kiesler declared, is “the only resistance to continuity . . . that keeps matter (the world) together.”²⁶ Movement in time resists static form; it creates continuous dynamic relationships between bodies and the environment. In time, Kiesler believed everything eventually becomes networked, relational, and continuous. Correalism as the science and biotechnique as the method, Kiesler argued, would facilitate the produc-



Top: Frederick Kiesler. *Time-Space-Architecture*, 1933-34. Space House sketch. Courtesy Kiesler Archive, Vienna.

Bottom: Frederick Kiesler. *Man = heredity + environment*, 1939. Drawing. H = Human environment; N = Natural environment; T = Technological environment; M = Man. From “On Correalism and Biotechnique: A Definition and the New Approach to Building Design,” *Architectural Record*, 1939.

tion of a total environment, a *Gesamtkunstwerk* of effects: they provide a “unified architectural principle” for design, one that, in Kiesler’s words, could achieve “Time-Space-Continuity.”²⁷ Believing his theory innovative, Kiesler trademarked the word *Correalism* in 1939 while completing his manuscript “On Correalism and Biotechnique.” An edited version of the manuscript was published in *Architectural Record* in September 1939, alongside images by Ezra Stoller of the Mobile-Home-Library built during the second year of Kiesler’s laboratory.²⁸

Laboratory Research

The first year of the laboratory was predominantly spent introducing correalism and biotechnique to the students and included general research on the study of variation and heredity in biology. In addition, Dr. Alexander Lesser, Dr. Gene Weltfish, and Dr. Robert S. Lynd of Columbia University spoke on anthropology and sociology. In an effort to teach students to think for themselves, Kiesler hoped to challenge architectural interests with broad intellectual influences that surrounded research on evolutionary practices relevant to design.

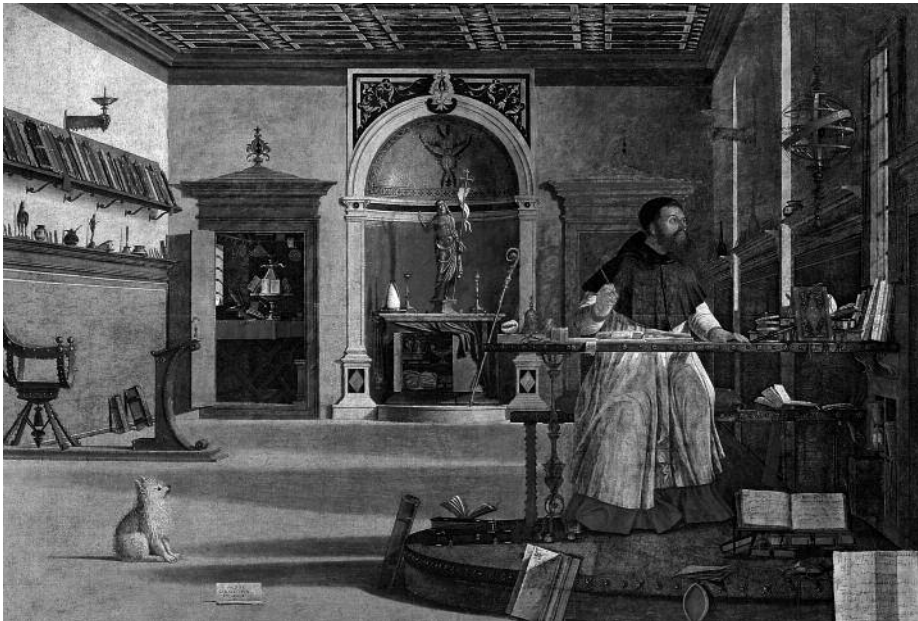
By the second year of the program, Kiesler had initiated several research investigations with his students addressing the problem of book storage in the home that produced pragmatic results. Student David Tukey began by charting and sketching new ideas for space economy, materials, light conditioning, and dust protection. He also consulted catalogs on stack manufacturing from Snead and Company and Shaw-Walker, as well as catalogs on metal office equipment from GF. Kiesler had Tukey, Alden Thompson, and Ronald Kaufmann complete a survey of problems for storing books in the home.²⁹ Students discussed several apartment- and home-planning arrangements of “elastic” spatial configurations with continuous built-in furnishings, as designed by Richard Neutra and others.³⁰ He then asked the students to make a report on an illustrated study of Vitorrio Carpaccio’s *St. Jerome in His Study* (which was actually Carpaccio’s *Vision of St. Augustine*) found in J.W. Clark’s *The Care of Books* in order to examine the “psycho-physiological succession” from “optical tactilism to manual tactilism” needed to establish contact with a book.³¹ This included studies of revolving storage devices, in addition to examinations of the progression from vision to touch (i.e., from eye, to grasping, to movement of the foot) involved in the process of securing a book.

Kiesler’s assignments analyzed relevant historical, technical, and manufacturer research and began to elaborate contemporary scientific studies to explore the body’s relationship to the natural and built environment. To study the spatial effects of apperception on the visual and

Vittorio Carpaccio.
Vision of St. Augustine, ca. 1502.

tactile habits of the user, Kiesler initiated a series of experiments described as “contact-cycle studies.”³² Students imagined and recorded the experience of seeing and obtaining a book from what they believed was St. Jerome’s library, for example. They envisioned moving about the room in various scenarios as they invented time-motion diagrams and charts of the virtual and habitual experiences of occupying space. Similar to diagrams originally generated by Christine Frederick in her studies of time management for the home in 1912, the temporal charts created by Kiesler’s students recorded human actions. These investigations prescribed positivist agendas to examine the body and its habits. Students scientifically observed, dissected, codified, and recorded bodies-in-motion to imagine and test the limits of spatial designs and their organization.

Adding to these contact-cycle studies, Thompson began a series of scientific explorations into the “present day method of measuring fatigue”; he charted bioelectric systems of observing sensory, central, and motor nerve impulses.³³ The intention of these biotechnical studies was to disclose tenseness in the muscles between “contracting and relaxing phases.” By studying, for example, delicate electrical instruments developed at the University of Chicago, Kiesler proposed to measure muscle tension. Fine wires leading directly from body muscles to a recording instrument in these experiments were to be used to measure intensity of movement. Through this research, Kiesler endeavored to determine how bodies coordinated and tired when obtaining a book from a shelf. He then coupled these investigations of lassitude measurement with information garnered from studying Francis Gano Benedict’s 1905 respiration calorimeter in an attempt to quantify the molecular processes involved in energy balance, expenditure, and heat transfer. Students measured fatigue and the regeneration of bodies from their contact cycle studies of St. Jerome’s library and produced calculations of labor performance in foot-pounds. From these investigations, Kiesler intended to derive a home library prototype of energy and timesaving efficiency. To ensure



this result, students examined successful case studies, including a circular desk at Harvard Law Library and several examples of mobile, flexible, and modular furniture published in Herbert Hoffmann's treatise *Gute Möbel* and Adolf G. Schneck's *Das Möbel*.³⁴

In all of these investigations, Kiesler and his students gave special attention to the study of moving bodies and systems in order to create readily accessible constructions. Many of the furniture designs that the students studied had varied mechanisms to fold and unfold a series of surfaces into multiple and extended parts. Joinery and hinging systems became extremely important, as did the interactive study of direct access to storage devices. Kiesler and his students drew several charts and diagrams to accompany their study of bodies reaching, extending, standing, and bending to use books at different times for different purposes.

The correlation between furniture and the moving body was vital to Kiesler's project. Any "maladjustment between the body and some parts of its environment, external or internal," Kiesler argued, would "impair the efficiency of the body," leading to increased "physical resistance," unbalanced health, and, in the extreme if not simply absurd case, "a progression from fatigue to death."³⁵ "*Architecture*," Kiesler explained, is



“a tool for the control of man’s [physical and mental] health, its de-generation and re-generation.” He believed aligning architecture with bodies-in-motion would guarantee a harmonious and balanced interaction between humanity and its technological environment. Coordination between the body and its surroundings would create a healthy exchange of forces that “mitigates physical and psychological maladjustments” by providing “*protection against fatigue* (preventive) and . . . *relief of fatigue* (curative).”³⁶ Architecture would thus function as a generator for the individual by protecting and replenishing one’s energy forces; it would serve to energize both the *physis* and the *psyche* of the dweller as it coordinated the habits of everyday actions on a molar and molecular level. “If I use the chair,” Kiesler maintained, “I accumulate its energy, I add it to mine”;

”when we use a chair we *absorb* its energy.”³⁷ Pseudoscientific theories of energy transfer between technology and the body situated in an ever-changing, adapting field suggested to Kiesler a state of pure automatism wherein the technological surface of elastic construction modulated in response to the body to control equilibrium and maintain good health.

Health has concerned architects at least since Vitruvius emphasized building in healthy climates. For Kiesler, science with its new technologies could be used to ensure healthier, more productive lives. Like Mensendieck and Mumford, Kiesler had hoped that bodies correlated to their environment would form everlasting symbiotic relationships. Where Mensendieck had systematically taught bodies to move with natural elasticity in response to different situations—ensuring lasting “beauty and health”—Kiesler scientifically studied bodies to design and test furniture that would move in correlation to the elasticity of bodily actions.³⁸ Where Mumford believed coordination between human needs, bodily desires, and machines would ensure an organic society of collective economy and leisure—without social distinctions—Kiesler anticipated that architecture designed to dissolve subject-object relations between bodies and their surroundings on a molar and molecular level would reenergize habitants and ease daily tensions and stress. For Kiesler, Mensendieck, and Mumford, fluid

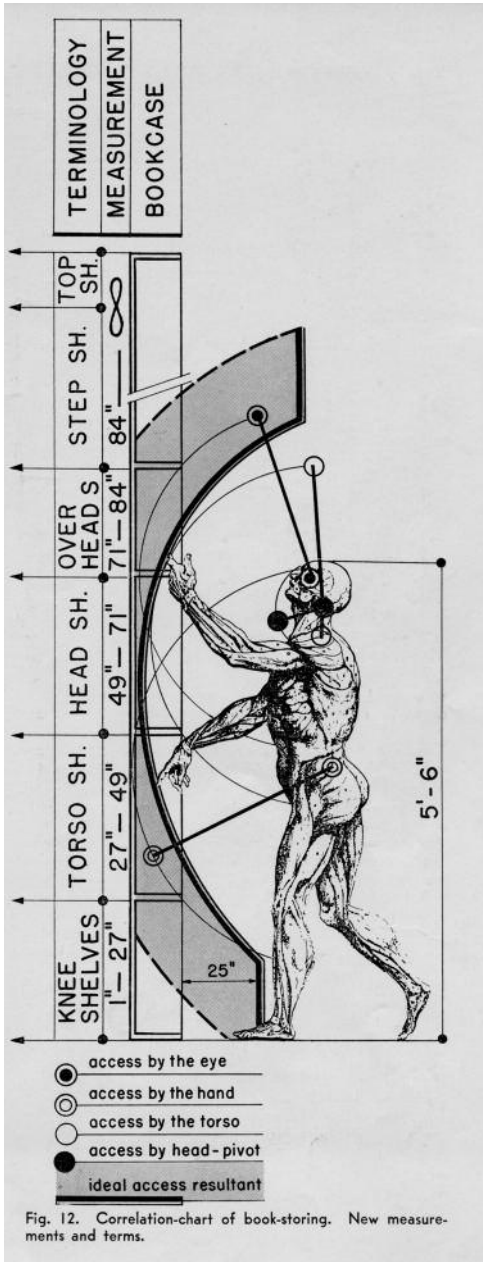


Fig. 12. Correlation-chart of book-storing. New measurements and terms.

Opposite, top: Bioelectric Research Experiment at The University of Chicago, 1928. Image from the Design Correlation Laboratory files. Courtesy Kiesler Archive, Vienna.

Opposite, bottom: Kalman Lengyel. Furnishings. From Herbert Hoffmann, *Gute Möbel: Zweite Folge, Band 3*.

Left: Frederick Kiesler. Biotechnical motion study. Figure from “On Correalism and Biotechnique,” *Architectural Record*, 1939.

continuity of the body-machine complex within its environment would ensure bodily control in the service of good forms of productive health.

To ensure the construction of healthy and productive biotechnological environments, Kiesler employed time-motion studies similar to those invented by Muybridge and Marey and later advanced by Frederick Taylor and Henry Ford. However, unlike Fordist practice that attempted to mold the body to the specialized demands of an efficient technological, mechanized workforce, Kiesler sought to develop “variation in technology” that might adapt to the needs of an evolutionary process of socioeconomic changes. “From deficiency to efficiency,” Kiesler charted how “actual needs are not the direct incentive to technological and socio-economic changes”; instead, he remarked, “needs are not static: they evolve.”³⁹ Kiesler proposed an organic architecture of the living machine (and not a machine for living) that might modulate to one’s motion in time as a consequence of one’s societal and bodily habits. Kiesler was not interested in a functional static architecture where bodies strain to move in a fixed environment but instead was interested in a biotechnological architecture that shifts the strain from human beings to their tools. Kiesler wanted technology to engage bodies in action in order to create a balanced environment of comfort and discomfort—relaxation and extension—contracting and expanding in a correlative time-space continuum. The Mobile-Home-Library was his attempt to achieve that goal.

The Mobile-Home-Library

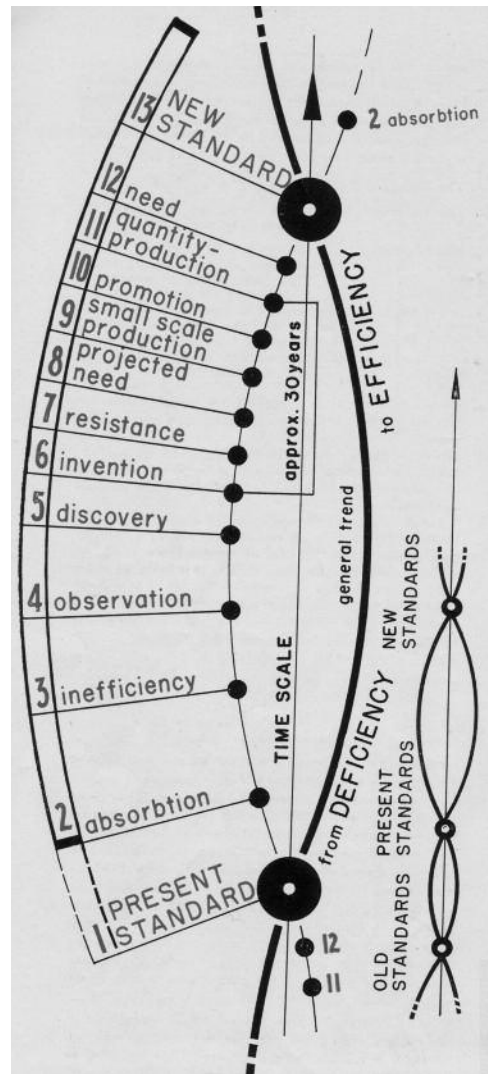
The Mobile-Home-Library constructed by professional manufacturers in coordination with Kiesler’s students Armand Bartos, Tukey, Kaufman, and Thompson appeared flexible and adaptable to different users. With shelf sizes increased to 15 inches with angular shape, the library could accommodate more types of books with varied arrangements. Each unit could rotate 360 degrees and be easily adjusted and transported between locations. Additional units could fit together or be taken apart. The home library was designed to physically engage bodies-in-motion. Three types of joints were custom designed to achieve varied action. A tubular system of chromium-plated steel construction telescopically extended to create more space for additional units. Units could be compiled in aggregates—stacked

Frederick Kiesler. Deficiency to efficiency, time scale chart. Figure from “On Correalism and Biotechnique,” *Architectural Record*, 1939.

Opposite, top left: Frederick Kiesler. Mobile-Home-Library, 1938–1939. Collaged photograph. Courtesy Kiesler Archive, Vienna. Photograph by Ezra Stoller.

Opposite, top right: Frederick Kiesler. Mobile-Home-Library, 1938. Figure from “On Correalism and Biotechnique,” *Architectural Record*, 1939. Photograph by Ezra Stoller.

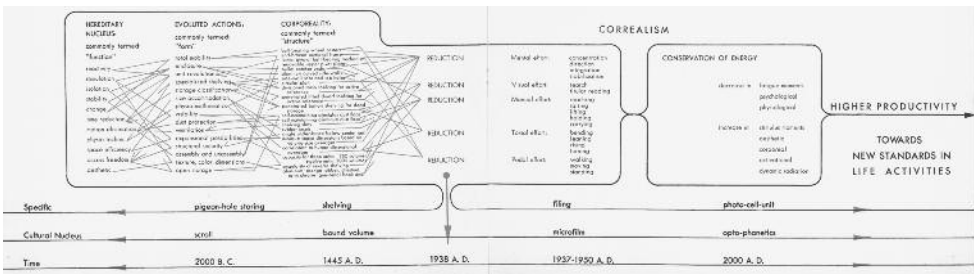
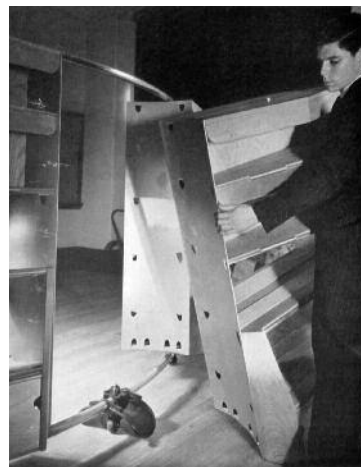
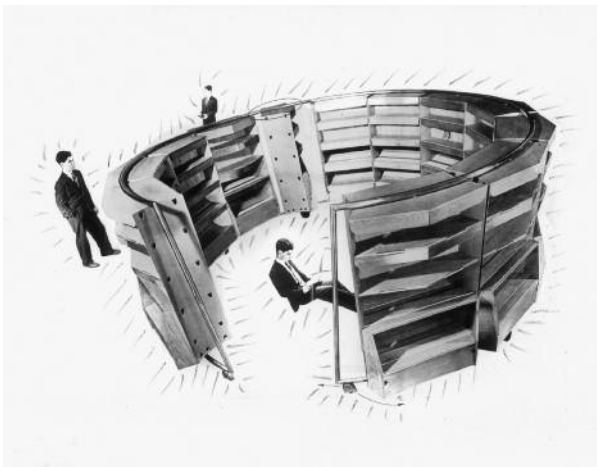
Opposite, bottom: Frederick Kiesler. Metabolism chart of Mobile-Home-Library, 1938–1939. Courtesy Kiesler Archive, Vienna.



beside one another flat against a wall or floating in space on a circular wheeled track. Additionally, as Kiesler noted, “by designing each unit of the library—as well as the total assembly—according to the physical limitations of man,” the storage system would reduce strain on the user to a minimum.⁴⁰ To optimize manufacture for future mass-customizable production, students tabulated and charted use frequencies and accessibility requirements alongside contact cycle studies.⁴¹ Motion-in-time was designed into the physical construction of the tectonic body as a temporal structure manufactured to house books—or, in the future, microfilm, television, optophonics, or any new sort of media.⁴² Multiplicity and temporality were built into the system.

Not limited to any one reading position or arrangement, the Mobile-Home-Library was designed to ideally support and facilitate multiple research forms and reading practices. The library did not have a centralized modular design that stored individual books to control easy access but instead allowed contact from a variety of standing and sitting locations as potentially needed by any number of information systems. The design exemplified a shift away from the formation of confined individualized spaces toward more-flexible modulating open control systems. Kiesler’s research laboratory thus engaged in experiments that supported an evolution occurring in human behavior or training during the mid-twentieth-century as philosopher Gilles Deleuze has recently identified—from the study and construction of static-fixed functional typologies toward the invention of machinic structures tailored to the needs of a constantly changing advanced capitalist society.⁴³

As a built work, however, the Mobile-Home-Library had its limitations. Its chestnut wood construction, chromium-plated steel, aluminum sheathing, and metal joints were only as flexible as the original design



prescribed; it could grow only to a certain extent; it could accommodate only an identifiable typology of books and information systems; it could not be designed for unforeseen changes in lifestyle or technology; and it could expand only in a linear direction against a wall or in a curvilinear manner upon a floor. Unable to adjust to changes in style, color, or material fetish, it was an object limited and characterized by its time and, ultimately, one that could not fully adapt to changes in environmental conditions.

Kiesler did realize both the promise and limitation of actual construction, however, and incorporated a theory he described as “time-zoning” into his design-correlation project. Time-zoning initiated during the design process recognizes the temporal limitations built in to any technological production; it considers the life-span “according to the stresses and strains of usage,” as well as the decay of its parts, on a sliding scale from durability to disposability. Life cycles and maintenance schedules are thereby a part of the design. “A time-zoned process of assimilation within the present domains of industries” is essential, Kiesler remarked; it replaces “the principle of static change . . . [with] the principle of continuous adaptation.” Despite its actuality, the Mobile-Home-Library was considered a standard type that would evolve variations based on observation, habituation, education, and invention. “Life-zoning of Building Materials” creates products, Kiesler suggested, that are designed to achieve an endless state of perpetual becoming.⁴⁴

Kiesler’s time-zoning process attempted to design products appropriate to the limits and extents of their use, while at the same time being cognizant of, and adaptable to, the ever-changing needs of varied situations. Kiesler hoped to produce designs that would not simply assimilate the body to repetitive known standards that he believed wasted human resources and impeded “technological progress,” and he fundamentally opposed habituating the public to simulated standards by selling the same mass-produced products over and over—a practice that, he argued, only perpetuated a cultural lag in favor of pure consumer profit. Instead, Kiesler aimed to properly coordinate manufacturing processes in “biotechnical research laboratories” as “the group expression” of the “consumer, the designer, the manufacturer, the distributor, [and] the salesman.”⁴⁵ In other words, he wanted to optimize the production capacity of the masses to endlessly create new evolving standards that supported innovative forms of future progress.

Kiesler believed technological progress aimed toward seamless continuity between bodies and machines would achieve ultimate human fulfillment. He did not lament the loss of human experience that might occur in this automatist process (as did philosopher Henri Bergson, for exam-

ple).⁴⁶ Instead he put his hope in an idea of continuous infinite progress even though technology might expropriate humanity from its human dimension to evolve more effectively with machines. In the 1930s and 1940s, Kiesler readily supported conflating bodies and machines in the service of technological materialist ideology, perhaps in contradistinction to any guiding moral or humanist values he may have cherished or hoped to believe.

Kiesler's biotechnological model for architecture aimed to maximize what he called "capital power" through new forms of production.⁴⁷ He thus embraced capitalism in service of "MASS PRODUCTION" but "NOT" as he argued "PRODUCTION FOR THE MASSES."⁴⁸ Promoting a biotechnic lifestyle expressly different from Mumford's Communist fantasy of mass leisure, Kiesler sought a healthy coordination between the body and its environment that would improve mass productivity by fine-tuning the body-machine complex to work to its greatest capacity. He promoted, in effect, a society of perpetual work in the service of mass markets for the "ultimate purpose" of enabling man to construct higher levels of continuous productivity. In Kiesler's biotechnic system, leisure was no longer a reward for work but an integral component of continuous satisfaction where liberatory actions and feelings were incorporated into productive daily routines. His laboratory carefully and systematically developed research into adaptable responsive mechanisms to harness life forces that increase work power. Kiesler's goal (whether desirable or not) was to form for every member of society a "BIOTECHNICAL MINIMUM STANDARD" that resulted in the construction of satisfyingly productive lives.⁴⁹

Social Design

Perhaps with this goal in mind, during the third and fourth year of the laboratory, Kiesler's research projects incorporated more-intensive time-motion investigations, as well as biological and evolutionary approaches to social design.⁵⁰ He discussed writings by Walter Rautenstrauch on "The Role of Organization in Attaining Optimum Productivity," which included studies of pattern organization, labor, and kinematics.⁵¹ Mario Salvadori provided several lectures on the origins of motion study, movement analysis, and Taylorism in the workplace and in housing.⁵² Additionally, Kiesler covered the evolutionary theories of Jean-Baptiste Lamarck, Charles Darwin, and Thomas Hunt Morgan, as well as studies on nervous systems, polyelectrophysiology, and radioactive rays.⁵³

The laboratory explored the human autonomic nervous system and its relationship to social conditioning. In lectures given on time-motion, students observed how architecture and industrial design not only facilitate

human action but also train the habits of everyday life. Salvadori taught students charting methods to quantify time spent on habitual actions such as smoking a pipe or packing luggage. They studied how the body learns to adjust to its environment, becomes “a slave to habit,” and how to problematize varied situations by asking “What is to be done? Who is to do it? Why [and When] should [and Where is an] operation [to] be performed?”⁵⁴ The laboratory then applied the students’ analytical strategies to study real-world conditions—for example, the social politics between a factory worker, foreman, and his management in the construction of a San Francisco housing project, compared to work relations at a prefabrication housing plant in Seattle.⁵⁵ Students examined the structure of work in correlation to political and social engagement on the job through both “Macromotion” and “Micromotion” investigations.⁵⁶ From these studies of how bodies move habitually in response to their physical, social, and political environments, students proposed ways to improve productivity and profitability. By lending conscious attention to areas of discontinuity, they assessed better elastic methods to ensure the plastic habits of bodily actions and rethought factory set-ups or invented new design or production tools.

By enabling more-fluid plastic states of action, Kiesler and his students hoped to generate greater human production power, an idea Kiesler derived in part from philosopher William James. Kiesler had been an avid reader of James’s theories on brain activity, habits, nerves, education, and the environment. He held James’s *The Energies of Man* and both volumes of the first edition of *Principles of Psychology* in his library.⁵⁷ In James’s formative studies at the turn of the twentieth century, he had observed that bodily habits are effectively “plastic”: they are “weak enough to yield to an influence, but strong enough not to yield all at once.” In habit, pure sensation drives us in the effortless custody of automatism to which we have become accustomed. Our daily actions are guided through a series of successive nervous events as if moving in a “continuous stream” unencumbered by conscious perception until we encounter disruption in our everyday patterns or workflow. Unaccustomed situations force us to stop or slow down until we learn to develop “change[s] of habit.” To streamline everyday actions, James advised educating human nature to the habits of multiple activities through “*continuity of training*” that might encourage new motor effects and free habits of will. James hoped “*to make our nervous system our ally*” by training people to develop multiple behavioral patterns early in life, as well as the flexibility of will to evolve new habits more readily, continuously, and frequently.⁵⁸ Kiesler attempted in his laboratory to extend James’s theories to the plastic arts by developing flexible systems that continuously supported and encour-

aged multiple changing habits. Kiesler's laboratory developed strategies to construct at an ever-increasing capacity architecture that would operate more smoothly and more seamlessly (i.e., that would be in sync) with evolving behavioral needs, wills, and desires.

In its effort to generate structures and systems most readily adaptable to constantly evolving forms of organic life, the laboratory became more and more interested in the adaptive potential of the sensory nervous system. Kiesler, like Rautenstrauch, believed that human beings both physically and psychically correlate in balance with their environment through nerves. The human nervous system senses its surroundings and coordinates necessary regulation. Because every social organism is a living system functioning in an ever-changing environment, its very existence depends upon its capacity to adapt. As Rautenstrauch argued, "social progress . . . will depend upon our ability to evolve a pattern of organized life which is an evolving pattern of organization of new functional equipments and expanding nervous systems to meet the needs of a constantly changing society." Arguing against static exogenic organizations that rupture under the pressure of expanding civilizations, Kiesler and Rautenstrauch instead believed organizational strategies must be developed that utilize endogenetic social and economic processes to survive.⁵⁹ For Kiesler, architecture was fundamentally an extension of the human nervous system, a prosthesis designed to innervate physical, social, and political environments.

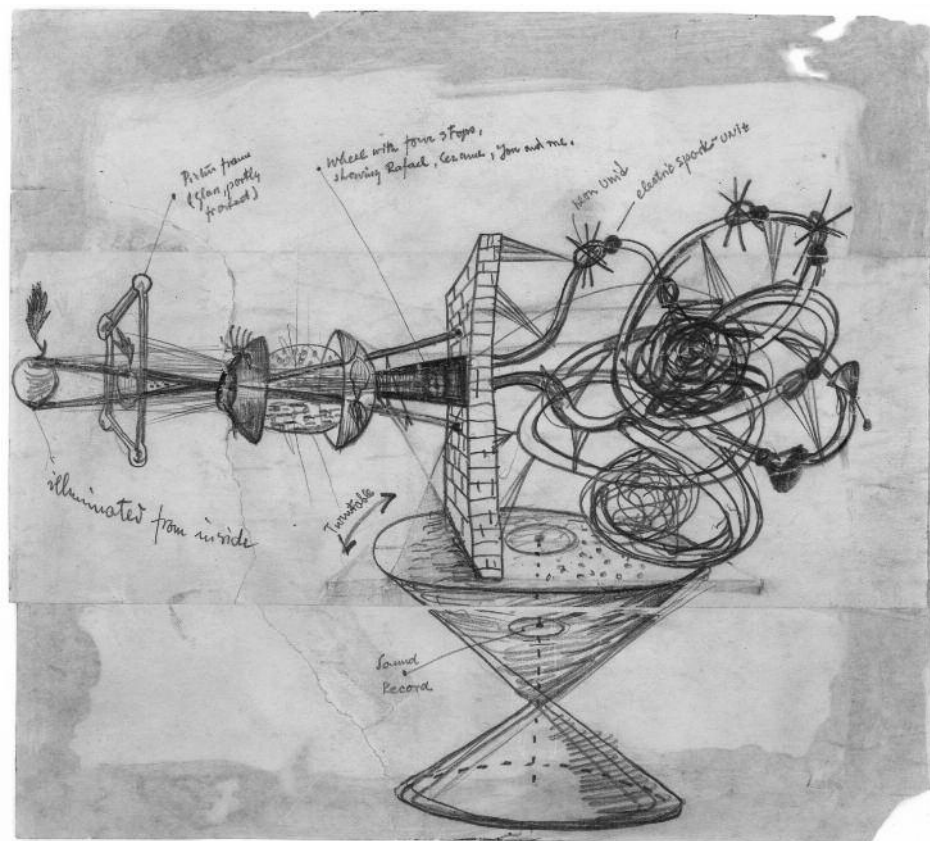
Vision Machine

Kiesler, in order to better understand the extensive capacity of the human nervous system relative to the plastic arts, made sensory perception, in particular vision, an important focus of the laboratory. In their research on St. Jerome's library for example, Kiesler and his students had observed that aesthetic and visual perceptions were integral to the fluid processes of seeing and securing books from shelves. To understand the decisive human mechanisms of choice and selection in these aesthetic practices, Kiesler began to pursue conversations with Columbia biophysics professor Selig Hecht on the precise nature of human vision. Hecht visited the lab in 1938 to lecture on the eye, gave Kiesler's students a short illustrated summary of its varied nerve functions, and had them study living retinas in the biophysics department. This technical research informed the design of the laboratory's well-known "Vision Machine."

The Vision Machine designed by Kiesler and his students aimed to show how networks of nerves correlate visual and tactile information between mind, eye, body, and the environment. The machine was modeled on the study of cathode tubes and X-ray machines and would be

operated through a rotary switch that generated a spark, which set the machine to motion. Gyrating continuously, the Vision Machine was intended to demonstrate the complete creative cycle of the imagination. To be constructed using an electrostatic generator, brass balls, blown glass tubes, colored gases, and electric wires, the Vision Machine appeared not altogether different from a push-button exhibit at a local science fair. It purportedly worked by reflecting light off an object; for example, an apple. The reflected light was then drawn into focus by an ocular aperture and projected onto an apparatus where it stimulated the flow of bubbles and gases through a network of tubes representing nerves and bodily systems. By using film animation technology, an excess of images—including artworks created by the blind, the insane, and small children— theoretically would stream forth from the machine. These images provided a visual depository of allied mental processes that simulated recognition, subconscious conflicts and associated prejudice, and previous experiences. From among the array of dreamlike images recollected and presented in accord with bodily affect and environmental conditions, a unified image would be created from a selection, and then reflected back onto the initial object—the apple.⁶⁰

Designed to show how perception is subjective—that is, temporal and personal—the Vision Machine supposedly would project choice selections from various users onto a screen for further study and analysis. Kiesler argued that his Vision Machine could replace the couch, chair, pencil, and pad commonly used in psychoanalysis because the Vision Machine would be able to take a “direct imprint of dreams” without inter-



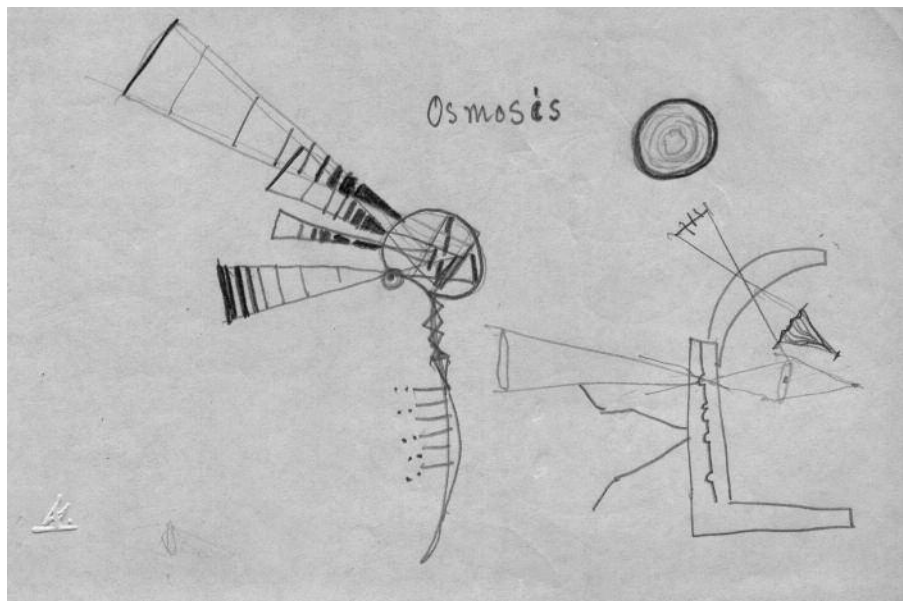
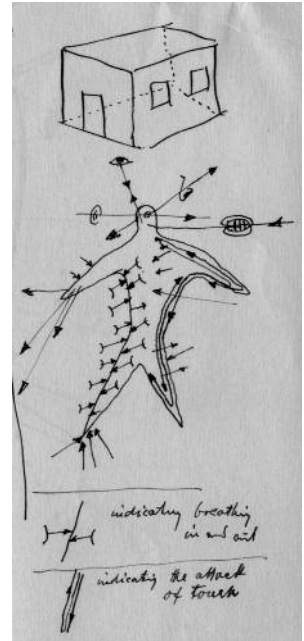
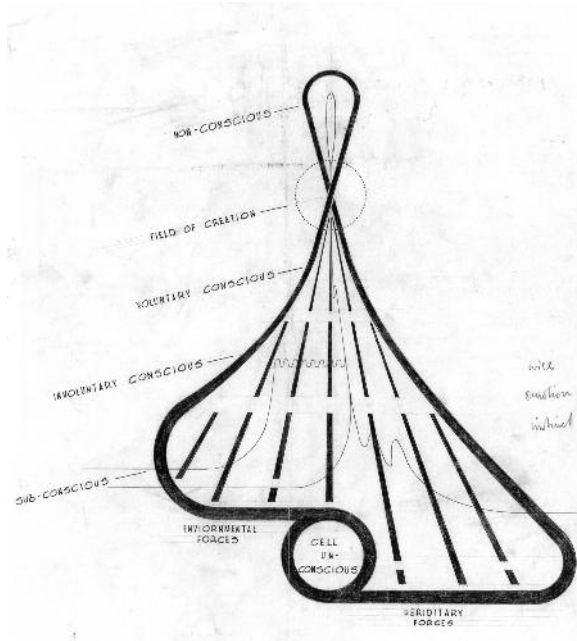
ference from the dreamer or the therapist.⁶¹ The Vision Machine was a Dream Machine designed to take snapshots of unconscious perception—what Kiesler called the “*after-image* of a memory flash.”⁶²

Although an avid reader of Freud’s basic writings, Kiesler (like James) dismissed interpretive methods of dream therapy in favor of popular scientific research on the inner workings of the mind and vision. Kiesler had hoped to use an electroencephalogram or cathode-ray tubes, electrodes, and an oscillograph to record on either light-sensitive materials or continuous rolls of automatically flowing paper—latent energies, excitations, and phosphorescence from deep inside the unconscious brain. He hoped successive visual recordings would produce more accurate images from a person’s memory and would thereby bypass study of the unconscious mind by therapists who are subject to their own or their patients’ biases. In his unpublished “Manuscript: Dream-Recorded,” Kiesler detailed his experimental research to observe direct dream images without the intermediary action of conscious perception.⁶³

In an attempt to understand human discernment that guides bodily actions, Kiesler probed the mechanisms and influences of the conscious and unconscious in his laboratory by, for instance, designing the Vision Machine to demonstrate the art of memory. The lab examined the process of memory recalled from the art of automatic writing, hypnosis, and dream theory and generated a history of imagery from early cave drawings to Marcel Duchamp’s paintings to clarify the interrelationship and physiopsychological sources of the origins of art. These studies enlivened their work and served to elaborate a series of diagrammatic sketches on environmental, hereditary, and intuitive forces acting on the mind and body in the art of plastic creation.

From their research, Kiesler and his students derived their own map of the mind and invented a model of sensory perception wherein the *physis* and *psyche* coexist within a continuous field of environmental and technological forces. They considered experience osmotic, habitual, and sensual, where qualities and intensities passed through semipermeable surfaces of networked internal and external nervous systems. They determined that manufactured technology coexists with the body—bound in continuum—whereby the visual apparatus makes cuts from the surrounding immanent field of matter, only to reconstitute through memory unique spatial perception. Space, Kiesler observed, is really a construct of recognition, because “what appears to be space is [simply] an illusion of it, merely a succession” of transpiring sensorial images coordinated in time.⁶⁴ Because succession is so rapid, conscious perceptions seem retrospective. Events are not known in the moment but choreographed in the body—like a quality, intensity, or feeling. Spatial perception is habitual.

Designed to investigate the processes of choice, feeling, and action associated with aesthetic perceptions, the Vision Machine potentially demonstrated the intimate processes of spatial imagination by simulating human memory, perception, and bodily affect. Similar to Bergson in *Matter and Memory*, Kiesler studied the body as a zone of indetermina- tion, as a screen that makes cuts in a field of excess images through choice selections that define subjectivity and personality based upon individual needs.⁶⁵ Where Bergson ideally hoped to return life to an immanent state of being by restoring plastic continuity between perceptions and needs (not limited by conscious attention), Kiesler proposed to construct pros- thetic devices that would enable human beings to live in greater continu- ity—habitually and autonomically—with their surroundings. Kiesler

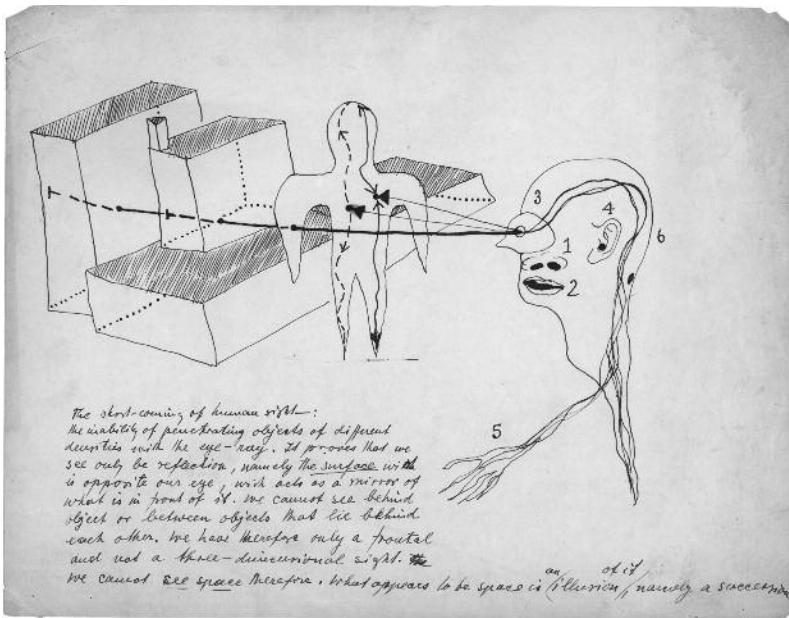


aimed in this regard to design architectural machines that could heal what he called the split between “fact” and “vision” (matter and memory) by facilitating processes of human discernment, and streamlining perceptions and actions.⁶⁶ Kiesler’s research points toward what Paul Virilio would later describe as a “new *industrialisation of vision*.”⁶⁷ Kiesler’s Vision Machine aimed to harness the central nervous system and externalize the imagination and creative cycle in order to instrumentalize it for design industry use. He wanted his research to provide artists and architects effective understanding of creative and optical sensibilities in order to support the design of more-continuous forms of productivity. By all accounts, however, Kiesler’s efforts failed miserably.

The Vision Machine was never built. In the words of Fuller, the laboratory “assumed far too pretentious a plant and budget, . . . their approach to design . . . [was] self-deceptive, . . . [and] they start[ed] with scientifically outmoded limitations.” Fuller berated Kiesler’s “esthetically emotional exclamations of ‘apperception,’” calling them “fatuous.”⁶⁸ “In short,” Fuller argued, the laboratory “looks like an innocuous and unconscious racket.” Others would agree. Eugene Raskin of *Pencil Points* publicly denounced Kiesler’s theories of correalism and biotechnique as being nothing more than mere “Cerebrationism & Vacuotechnique.”⁶⁹ Kiesler faced significant opposition to his research agenda, and in 1941 the Design-Correlation Laboratory was permanently shut down at Columbia. Although Kiesler attempted to remain on campus with support from external research funding, in June 1942 he was asked to vacate his office arguably because of a shift in priorities during the Second World War.

Research as Method

Despite his at times nonlinear, esoteric, and often misunderstood popular scientific approach to design research, Kiesler’s innovative ideas and methods at Columbia proved to be highly productive. His laboratory research in the construction of the Mobile-Home-Library and design of



Opposite and left:
 Frederick Kiesler. Vision
 Machine study, 1937–1941.
 Diagram. Courtesy Kiesler
 Archive, Vienna.

the Vision Machine supported his innovative practice in exhibition, housing, and theater design from the 1940s through the 1960s. The Vision Machine, for example, inspired several of Kiesler's optical displays for Peggy Guggenheim's Art of This Century (AOTC) galleries in New York City in 1942. Additionally, Kiesler's biotechnical studies into the correlation between bodies, technology, and the environment culminated in a unique organic architecture by the late 1950s and early 1960s—his Endless House and Universal Theater projects.

Kiesler's laboratory research also had an immediate impact on major educational institutions across the United States. Wells Bennett at the University of Michigan was convinced that Kiesler's innovative model for design research held great promise and consulted with Kiesler to establish similar scientific methods to design problems at Michigan. Cooper Union considered opening a laboratory of design-correlation in the 1940s. Walter Gropius at Harvard University in the 1940s promoted scientific study of vision and perception that was similar to Kiesler's work. In addition, Moholy-Nagy invited Kiesler to lecture on design-correlation in Chicago several times. Kiesler also received similar invitations from other major architecture schools.

The most significant interest in Kiesler's laboratory was shown by George Howe, the chairman of the Yale University School of Architecture, who in the 1940s discussed with Kiesler his innovative approach to design education and then invited him to develop his research at Yale in 1951 and 1952. Committed to introducing design research to the Yale School of Architecture, Howe provided the opportunity for Kiesler to revive his laboratory agenda with specific focus on biotechnical analysis. At Yale, Kiesler had his students in the second-year curriculum study the design and construction of a chair using research methods similar to those developed in the construction of the Mobile-Home-Library. Student Benjamin B. DuPont maintained a complete notebook on the Yale assignments. He included sketches of "Fixed & Variable" chair dimensions and a chart of "Feelings observed from sitting in [a] test rig" with the back "adjusted to best position." He also made a study of feet and legs extended with knees up and crossed for best back comfort and included a "Progressive Contact Support Study" showing steps from minimum contact to a fully relaxed position that included the body reclining with all fatigue points supported. For the final assignment, DuPont designed a seat with an expandable, soft cushion back to support multiple positions of the body "superimpose[d with] additional areas for shifting, manufacture, and tradition."⁷⁰ The Yale research was based on Kiesler's design for his own remarkable chair for the AOTC galleries, which could be repositioned for a variety of purposes; it could be lifted and moved about different rooms

Frederick Kiesler. Surrealist
Gallery, Art of This Century, 1942.
Photograph. Courtesy Kiesler
Archive, Vienna.

as needed to interact with the body in multiple positions—standing or sitting. His chair was modulated and shaped to shifting motions.

Kiesler's pedagogical aim was not to teach students to think for themselves by necessarily inventing the program and design of their own creative ideas but was to teach students to learn how to think critically and independently in response to their professor's original design research. In the final years of Kiesler's Columbia laboratory, for example, students devised several independent projects that developed upon Kiesler's ideas: Kaufmann designed a flexible reading lamp; Bartos started a sociological study on the family; Florence Doe prepared an outline for an investigation of primitive dwellings for emergency shelters and early housing in China; Paula Mann prepared a bibliography on color; and Stark designed an inexpensive linear-wall-library.⁷¹ Kiesler's pedagogical plan was similar to the laboratory sciences' model, which sets out to teach students research as a method so that they might learn to generate original experiments. Although this form of education means that students begin their research in response to a particular school of thought, it creates an ongoing dialogue between generations in an effort to evolve new design trends.

Kiesler's innovative laboratory research challenged the normative practices of the time. His teaching methods, although similar to those of Charles and Ray Eames, George Nelson, and others, was still surprisingly controversial even in the early 1950s. Howe had hoped to establish a permanent position for Kiesler to teach his design research seminar at Yale, but the university determined Kiesler's research philosophy and methods were not appropriate to the larger educational goals of the institution, and he was not invited to return. The postwar climate required far more direct and practical training of young architects in order to address the need for housing and new building, and speculative methodological



research explorations that encouraged critical thinking and challenged functional modern prototypes were deemed inappropriate. Architecture schools were not, it seemed, interested in teaching design students the research skills needed to generate innovative and visionary ideas, but instead wanted to train students with the practical design and construction skills necessary to produce accepted conventions for mass distribution. “How much money is wasted to teach pseudo-modernism” was Kiesler’s retort to this ultimate rejection.⁷²

Kiesler also fell short in his own ambitions to educate students to think about the work they were producing. His work marks a prescient moment in the history of modern design. His laboratory research engaged scientific study of dynamic bodily habits and sensorial affects to support shifting biopolitical structures aimed at advancing capitalist markets and evolving control societies.⁷³ Although Kiesler’s body of work would later suggest alternative and more-resistive liberatory applications, his efforts to produce responsive systems designed to modulate to the qualities and intensities of dynamic bodies-in-motion most often seemed to facilitate and promote a society of unconsciously motivated actions. In a contemporary context where architecture research laboratories are continuing to emerge internationally—with ever-greater claims toward innovative study of continuous forms, responsive systems, and sensational affects—Kiesler’s challenges and failures as an educator are even more poignant today. Regardless of one’s own values or institutional biases, to teach students to unwittingly speculate, experiment, and produce is simply not enough. As educators, we are also responsible for teaching students to think about what they are learning to do.

Notes

This essay is a revised chapter from my dissertation “Elastic Architecture: Frederick Kiesler’s Research Practice—A Study in Continuity in The Age of Modern Production” (Ph.D. diss., Princeton University, 2008) that includes full acknowledgments.

1. See William Emerson, FAIA, to Dean Leopold Arnaud, 6 May 1940, in Laboratory for Design Correlation (LDC), REC 10 Box, Unmarked Folder, in Austrian Frederick and Lillian Kiesler Private Foundation Archive, Vienna (hereinafter referred to as Kiesler Archive, Vienna). See also “The Ann Arbor Conference,” *Pencil Points*, March 1940, 70.

2. See “Plans Laboratory of Modern Stage: Former Vienna Director Says He Will Develop ‘Fourth-Dimensional Theatre’ to Exemplify Democracy—‘Psychological, Scientific, and Artistic’ Instruction Will Be Given,” *New York Times*, 15, March 1926, in Frederick Kiesler Papers, microfilm reel 127, Archives of American Art, Smithsonian Institution, Washington, DC (hereinafter referred to as Kiesler Archive, Washington, DC).

3. “International Theatre Arts Institute,” course description and program, n.d., 6, in Kiesler Archive, Vienna; emphasis added.

4. See Lillian Kiesler, “Books in The Personal Library of F. Kiesler,” in Lillian Kiesler Papers, 1920s–2001, Box 21, Inventory Folder, 21 February 1983, 1–127, Archives of American Art, Smithsonian Institution, Washington, DC (hereinafter referred to as Lillian Kiesler Archive, Washington, DC). See also Walter Russell, *The Russell Genero-Radiative Concept or the Cyclic Theory of Continuous Motion* (New York: L. Middleditch Co., 1926; rev. 1930). An original signed by Matchabelli is in the Kiesler Archive, Vienna.

5. “International Theatre Arts Institute,” 12.

6. “International Theatre Arts Institute,” 8.

7. Bess M. Mensendieck, *It’s Up to You* (New York: Mensendieck System, 1931) 33; emphasis in original. See also Robin Veder, “The Expressive Efficiencies of American Delsarte and Mensendieck Body Cultures,” *Modernism/Modernity* (forthcoming).

8. Mensendieck, 104–105. See also “International Theatre Arts Institute,” 8.

9. “American Opera Designs,” *Architectural Forum* 76 (January 1942): 16.

10. See Theodore Rohdenburg, *A History of the School of Architecture: Columbia University* (New York: Columbia University Press, 1954), 38–39. This is available in the University Archives and Columbiana Library, Columbia University, New York.

11. Frederick Kiesler, “First Report on the Laboratory for Design Correlation,” 1937, 3–4, in LDC, REC 03 Box, Activities/Reports, Reports on the LDC Folder, Kiesler Archive, Vienna. See also Frederick Kiesler to Wells Bennett, 1 May 1940, LDC, REC 10 Box, Unmarked Folder, Kiesler Archive, Vienna.

12. Kiesler, “First Report,” 2.

13. Frederick J. Kiesler, “Notes on Architecture: The Space-House,” *Hound & Horn*, January–March 1934, 292.

14. Frederick Kiesler, “A Laboratory for Social Architecture,” n.d., 1, in LDC, REC 03 Box, Activities/Reports, Reports on the LDC Folder, Kiesler Archive, Vienna.

15. Frederick Kiesler, “On Correalism and Biotechnique: A Definition and the New Approach to Building Design,” *Architectural Record* 86 (September 1939): 67; emphasis in original. Geddes used the word *biotechnics* in 1925 to define a new field of applied biology. See Patrick Geddes and Sir Arthur Thomson, *Biology* (London: Henry Holt and Co., 1925), 245–246.

16. Lewis Mumford, *Technics and Civilization* (New York: Harcourt, Brace and Company,

1934), 353–356.

17. R.H. Francé, *Plants as Inventors* (New York: Albert and Charles Boni, 1923), 6–8. The work was originally published as *Die Pflanze als Erfinder* (Stuttgart, 1920).

18. See Detlef Mertins, “Living in a Jungle: Mies, Organic Architecture and the Art of City Building,” in *Mies in America*, ed. Phyllis Lambert (Montreal: Harry Abrams, 2001), 590–642. See also Oliver Botar, “Prolegomena to the Study of Biomorphic Modernism: Biocentrism, László Moholy-Nagy’s ‘New Vision’ and Ernő Kállai’s Bioromantik” (Ph.D. diss., University of Toronto, 1998), 238; and Philip Steadman, *The Evolution of Designs: Biological Analogy in Architecture and the Applied Arts* (New York: Cambridge University Press, 1979), 163.

19. See László Moholy-Nagy, *The New Vision: Fundamentals of Design, Painting, and Sculpture*, trans. D.M. Hoffmann (New York: Brewer, Warren & Putnam, Inc., 1930), 53, 120. The work was originally published as *Von Material zu Architektur* (Munich: Langen, 1929).

20. See Beatriz Colomina, “De psyche van het bouwen: Frederick Kiesler’s Space House,” *Archis*, November 1996, 71.

21. Kiesler, “Notes on Architecture,” 296.

22. Patrick Geddes, *Evolution* (New York: Henry Holt, 1911); and R.S. Russell, *Form and Function: A Contribution to the History of Animal Morphology* (1916; Chicago: University of Chicago Press, 1982).

23. Buckminster Fuller, “Correlation,” *Shelter* 2, no. 4 (May 1932): 3.

24. See William W. Braham, “Correalism and Equipoise: Observations on the Sustainable,” *Arq* 3, no.1 (1999): 58. Kiesler used *correlation* and *correalism* interchangeably beginning around 1934.

25. Kiesler, “On Correalism and Biotechnique” (1939), 61, 69; emphasis in original.

26. Frederick Kiesler, “From Functional Design to Service Design,” n.d., in Design Correlation Drawing Folder, Kiesler Archive, Vienna.

27. Frederick J. Kiesler, “Notes on Architecture,” 293. See also Frederick Kiesler, “Progression-Chart of Architecture,” n.d., Miscellaneous Sketches, Notes, and Drafts, Space House Folder, Kiesler Archive, Vienna.

28. Frederick Kiesler, “On Correalism and Biotechnique,” unpub. ms., 1938, 1-95, in Design Correlation Manuscript Box, Kiesler Archive, Vienna (hereinafter cited in text as CBM, with relevant page numbers). See also Kiesler, “On Correalism and Biotechnique” (1939), 60-75.

29. Frederick Kiesler, “Second Report of the School Year, 1937–38 of the LDC,” 1937–1938, 1–2, in LDC, REC 03 Box, Activities/Reports, Reports on the LDC Folder, Kiesler Archive, Vienna.

30. Frederick Kiesler or students, original sketches, n.d., in LDC, REC 07 Box, Student work/Plates, Box Folder no. 6, Kiesler Archive, Vienna.

31. See “Multiple Unification, a Study by: Ideographic Disintegration,” Student Report, n.d., 2, in LDC Files, Box 8, Series 11, Kiesler Archive, Vienna. Clark conducted a study of library arrangement based on what he incorrectly believed was Carpaccio’s painting of *St. Jerome in His Library*; Kiesler and his students reiterated the mistake. See Spyros Papapetros, “Saint Jerome in his Modernist Study: An Afterword to Adolf Behne’s *Eine Stunde Architektur*,” *Pidgin* 6 (January 2009), 249. See John Willis Clark, *Care of Books: An Essay on the Development of Libraries and Their Fittings, from the Earliest Times to the End of the Eighteenth Century* (Cambridge, UK: Cambridge University Press, 1901;

reissued 1909), fig. 143.

32. See “St. Jerome’s Library, Contact Cycle Studies: ‘Chance Description for Graphic Mutation of J.W. Clarks’ *The Care of Books* Page 300 from a Painting by Vittore Carpaccio,” Student Report, n.d., 1, in LDC Files, Box 8, Series 11, Kiesler Archive, Vienna.

33. Kiesler, “Second Report,” 2. See also “Student Work/Plates: Fatigue Measurement”, n.d., in LDC, REC 07 Box, Box Folder no. 2, Photostat Series 2–13, Kiesler Archive, Vienna.

34. Frederick Kiesler, “Energy and Time-Saving Circular Desk at Harvard Law School,” n.d., in LDC, REC 07 Box, Box Folder no. 6, Kiesler Archive, Vienna. See also Kiesler’s notes on *Das Möbel* and *Gute Möbel*, n.d., in LDC, REC 07 Box, Box Folders nos. 5–6, Kiesler Archive, Vienna. For original images see Herbert Hoffmann, *Gute Möbel: Zweite Folge, Band 3* (Stuttgart: Julius Hoffmann Verlag, 1934) and Adolf G. Schneck, *Das Möbel als Gegrachsgegenstand* (Stuttgart: Julius Hoffmann Verlag, 1929).

35. Kiesler, “On Correalism and Biotechnique” (1938), 12, 14.

36. Kiesler, “On Correalism and Biotechnique” (1939), 65–66; emphasis in original.

37. Kiesler, “From Functional Design to Service Design;” emphasis in original.

38. See Mensendieck, *It’s Up to You*, 293.

39. Kiesler, “On Correalism and Biotechnique” (1939), 64; emphasis in original.

40. Kiesler, “On Correalism and Biotechnique” (1939), 71.

41. See Alden Thompson, “Contact Cycle Study Oct. 31 1938,” and “Another Contact Cycle Study at United Metal Work Co. Oct. 25, 1938,” Design Correlation Laboratory, REC 10 Box, Final Folder Thompson, Kiesler Archive, Vienna.

42. Kiesler, “On Correalism and Biotechnique” (1939), 68–69.

43. See Gilles Deleuze, “Postscript on Control Societies,” *Negotiations: 1972-1990*, trans. Martin Joughin (New York: Columbia University Press, 1995), 178–179. This essay originally appeared in *L’Autre journal*, no. 1 (May 1990), and was included in *Pourparlers* (Paris: Editions Minuit, 1990), and *October* 59 (Winter 1992), 3–7.

44. Kiesler, “On Correalism and Biotechnique” (1938), 63–64, 93–95.

45. Kiesler, “On Correalism and Biotechnique” (1938), 93.

46. See Henri Bergson, *Time and Free Will: An Essay on the Immediate Data of Consciousness*, trans. F.L. Pogson (New York: Dover Publications, 2001). The work was originally published as *Essai sur les données immédiates de la conscience* (1889).

47. Kiesler, “On Correalism and Biotechnique” (1938), 85.

48. Kiesler, “On Correalism and Biotechnique” (1938), 90.

49. Kiesler, “On Correalism and Biotechnique” (1938), 76, 78.

50. See Frederick Kiesler, “Report on the Work of the LDC Nov. 13, 1939,” 6–8, in LDC, REC 03 Box, LDC Activities/Reports, Kiesler Archive, Vienna.

51. Walter Rautenstrauch, “The Role of Organization in Attaining Optimum Productivity: Reprint of Synthese Maandblad voor het geestesleven van onzen tijd April 1939: Paper Submitted to the 1938 Study Conference of the International Industrial Relations Institute, The Hague, on the Subject of Productivity and Standards of Living as Influenced by Industrial Relations,” in LDC, REC 08 Box, Series 11, 1–13, Kiesler Archive, Vienna. Rautenstrauch was a professor in the department of industrial engineering at Columbia University.

52. See Mario Salvadori, “Time and Motion Study Lectures,” in Frederick Kiesler “Fourth Report on the LDC,” February–March 1940, 7, in LDC, REC 03 Box, Laboratory

for Design-Correlation Activities/Reports, Kiesler Archive, Vienna. Salvadori was a professor of engineering at Columbia.

53. Kiesler, "Report on the Work of the LDC Nov. 13, 1939," 7–8.

54. D. Newman, "Report on 'Time-Motion' Lecture by Mr. Salvatore," n.d., in LDC, REC 08 Box, Series 11, Kiesler Archive, Vienna.

55. Salvadori, "Time and Motion Study Lectures," 7. See also Henry Balisky, "Theory of form, function, and structure," 3/10/41, in LDC, REC 08 Box, Series 11, 1-3, Kiesler Archive, Vienna.

56. Salvadori, 7.

57. See Lillian Kiesler, "Books in The Personal Library of F. Kiesler," 112–114.

58. William James, *The Principles of Psychology*, 2 vols. (1890; New York: Dover Publications, Inc., 1950), 1:105, 107, 114, 122–123; emphasis in original.

59. Rautenstrauch, 2–3, 9.

60. See "Brief Description of Vision Machine," n.d., in Vision Machine Box, VM_Descriptions and Memorandum, Kiesler Archive, Vienna.

61. Frederick Kiesler, "Manuscript: Dream-Recorded," n.d., 10, in LDC, REC 10 Box, Columbia School of Architecture Envelope, Kiesler Archive, Vienna.

62. Frederick Kiesler, "Some Testimonial Drawings of Dream Images," in *VVV Almanac no. 1*, ed. David Hare (New York: VVV, 1942), 29; emphasis in original.

63. Kiesler, "Manuscript: Dream-Recorded," 6–10.

64. Frederick Kiesler, original sketch, n.d., in Vision Machine Box, VM_Iconographic Images Folder, Kiesler Archive, Vienna.

65. Henri Bergson, *Matter and Memory* (New York: Zone Books, 1988), 38–39. Originally published as *Matière et mémoire* (Paris: Presses Universitaires de France, 1908).

66. See Frederick J. Kiesler, "Magic Architecture: Origin and Future—The Story of Human Housing," unpub. ms., n.d., Part 1, Introduction, 1, in Magic Architecture Manuscript Box, Kiesler Archive, Vienna.

67. Paul Virilio, *The Vision Machine* (Indianapolis: Indiana University Press, 1994), 59; emphasis in original.

68. Buckminster Fuller to F.J. Kiesler, 14 April 1939, in Frederick Kiesler Letters, Microfilm, Getty Research Institute, Los Angeles.

69. Eugene Raskin, "Cerebrationism and Vacuotechnology: The Great Architect Evolves a New Theory," *Pencil Points*, December 1939, 791–792.

70. "Notebook by Benjamin B. DuPont September 30 1952 Architecture 21 Mr. Kiesler," 1952, in LDC, REC 10 Box, Kiesler Archive, Vienna.

71. Kiesler, "Report on the Work of the LDC Nov. 13, 1939," 8; Kiesler, "Second Report," 3; and Kiesler "Fourth Report," 1–2.

72. Frederick Kiesler to George Howe, 21 June 1952, in Frederick Kiesler Papers, Box 4 of 7, Correspondence 1951–1952 Folder, Kiesler Archive, Washington DC.

73. See Sven-Olov Wallenstein, *Bio-politics and the Emergence of Modern Architecture* (New York: Princeton Architectural Press, 2008).