Practice: Architecture, Technique + Representation is a book of essays by architect Stan Allen. Conversant in contemporary theory and architectural history, Allen writes from his perspective as a working architect, rather than that of a critic or historian. Architecture has always been a synthetic discipline, constantly importing ideas from other fields, but those concepts, as they enter architecture's field of operations, are transformed by the specificity of the architect's expertise. The book examines this tension between architecture's definition of itself as an autonomous discipline, and an always changing landscape of ideas and technologies. This new edition includes revised essays together with previously unpublished work. Allen's seminal piece on Field Conditions is included in this reworked, revised and redesigned volume.

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I. CONSTRUCTING WITH LINES:
On Projection

It is quite possible to project whole forms in the mind without recourse to the material, by designating and determining a fixed orientation and conjunction for the various lines and angles.

L. B. Alberti

ARCHITECTURE IS OFTEN DEFINED AS THE ART—OR SCIENCE—OF BUILDING. YET ARCHITECTS, WHEN THEY BUILD, INFLUENCE CONSTRUCTION ONLY INDIRECTLY, AT A DISTANCE. AS ROBIN EVANS HAS SUCCEINTLY PUT IT, "ARCHITECTS DO NOT MAKE BUILDINGS, THEY MAKE DRAWINGS FOR BUILDINGS." IN ALBERTI'S TREATISE, A PRIVILEGED PLACE IS ASSIGNED TO THE ABSTRACT, INTELLECTUAL WORK OF LINEAMENTS—LINEAR CONSTRUCTS PROJECTED "IN THE MIND," AS OPPOSED TO MATERIAL CONSTRUCTIONS IN THE WORLD. BUT TO SEE THE WORKING CONSTRUCTIONS OF THE ARCHITECT—DRAWINGS, MODELS, NOTATIONS, OR PROJECTIONS—AS SIMPLY OPPOSED TO THE CONCRETE PHYSICAL REALITY OF BUILDING IS TO MISS WHAT IS SPECIFIC TO ARCHITECTURAL REPRESENTATION. PROJECTION, IN PARTICULAR, IMPLIES MOVEMENT, TRANSFORMATION. BY THE TRANSLATION OF MEASURE AND PROPORTION ACROSS SCALE, ARCHITECTURAL PROJECTIONS WORK TO EFFECT TRANSFORMATIONS OF REALITY AT A DISTANCE FROM THE AUTHOR. PROJECTIONS ARE THE ARCHITECT'S MEANS TO NEGOTIATE THE GAP BETWEEN IDEA AND MATERIAL: A SERIES OF TECHNIQUES THROUGH WHICH THE ARCHITECT MANAGES TO TRANSFORM REALITY BY NECESSARILY INDIRECT MEANS.

HUNTING THE SHADOW

Many discussions of drawing begin with the classical legend of the origin of drawing. As narrated by Pliny the Elder in his Natural History, the story is marked by themes of absence and desire. Diboutades, daug-
ter of a Corinthian potter, traces with charcoal the outline of the shadow cast by the head of her departing lover. Projection is fundamental to the story. Diboutades traces not from the body of her lover but from his shadow—a flat projection cast on the surface of the wall by the soon-to-be absent body. At the moment of tracing, Diboutades turns away from her lover and toward his shadow. Information is always lost in projection: the fullness and physicality of the body is converted into a two-dimensional linear abstraction. The drawing stands in for the absence of the lover: an incomplete image to recall a lost presence.

The legend of Diboutades stages a relationship between a body and its representation, mediated by flatness and projection. The drawing records in abstracted form something that already exists but will soon be absent. It will act as a token to recall the memory of the lover when he is no longer present. The legend enacts classical theories of mimesis—art imitates nature, and the presence of the subject precedes the artifice of representation. In classical thought, the representation can be more or less accurate, but it will always be secondary, a shadowy simulation of a preexisting reality.

The function of representation in architecture is related but distinct. In "Translations from Drawing to Building," Robin Evans contrasts the typical product of the academic painter to a version of the Diboutades story painted by Karl Friedrich Schinkel. Two significant differences emerge. In the version from the academic tradition, the light is from a candle and the scene takes place in an intimate interior setting. Schinkel's version is set out-of-doors, and the rays of the sun provide the source of light. The sun's rays, for practical purposes considered parallel, produce an orthographic projection, while the radiating vectors of the candlelight effect a type of projection more closely related to single point perspective. Hence, the architect's version employs the abstract projection of the mechanical draftsman—measurable and precise, capable of transmitting information—while the painter's version employs a more pictorial projection, producing an iconographic image.

Second—and more significant—is the scene of the drawing itself. In Schinkel's painting, the tracing is executed by a young shepherd, under the command of a woman who directs the act of drawing while steadying the head of the model. The painting depicts not an intimate interior setting, sheltered by an already fully formed architecture, but a pastoral scene, and a complex social exchange. Instead of a dressed plaster wall, the shadow is traced out on the more or less even surface of a stone ledge in the landscape. As Evans points out, for Schinkel, the neoclassical architect, drawing necessarily precedes building and its subsequent codification of the norms of social behavior and civilization. Without drawing there is no architecture, or at least no architecture as Schinkel would have understood it: a classical architecture of regulated proportions and integrated formal orders. Drawing is identified with abstract speculation and geometry, and in turn, with social formation. Despite his portrayal of drawing as a more complex social scene, Schinkel has depicted the act of tracing at exactly the moment when the stylus rests on the shadow of the eye, as if to indicate the primacy of vision.

Schinkel's painting suggests that classical theories of imitation fall short of explaining the workings of architectural drawing. In architecture there is no preexisting object to imitate: no body to cast a shadow.¹ Once established and codified, architecture tends to imitate preexisting architectures; but what does it originally
Devlamynck — The Invention of Drawing. After a Painting by Joseph Suvée, 1791
Karl Friedrich Schinkel. The Invention of Drawing. 1830
imitate? Or, as Mario Carpo has put it, “How do you imitate a building that you have never seen?"6 Alberti, for example, states that architecture imitates nature by subscribing to the same set of abstract, cosmological ordering principles. Architecture imitates nature through harmony, number and proportion. In enlightenment architectural theory, the figure of the primitive hut is introduced; architecture imitates nature by finding its origins in the most basic and “natural” of architectural forms. But if classical architecture imitates nature in the form of the primitive hut, it does so only through a highly abstract and idealized geometrical mediation. Even later attempts to link architecture more closely to a mimetic idea of nature—Viollet-le-Duc’s idea that the logics of structure imitate organic structure, or Gottfried Semper’s idea of the wall as a woven mat—do so through conventionalized (and abstract) means. Multiple layers of convention, history, geometry, and form-making intervene to make these stories of origin unconvincing.

As in the legend of Diboutades, architectural drawing is marked by the sign of absence. But unlike classical theories of imitation, the represented object does not exist prior to its depiction in drawing: not something that once was and is no longer present, but something not yet present. Buildings are both imagined and constructed from accumulated partial representations. The drawing as object, like the musical score in performance, disappears at the moment of construction. But how is this transformation accomplished? Projection translates measure, interval and profile from two to three dimensions, across scale. Difference, as much as correspondence, configures the translations between drawing and building. Drawing heavily on Robin Evans’ insights on the functioning of projection, this essay surveys specific practices of projection—perspective, anamorphosis and axonometric—in their historical and theoretical context. My interest throughout is in the interplay between the abstract constructions of drawing and architecture’s specific capacity to transform reality.

To examine techniques of representation in this way is neither to suggest that architecture could ever be exclusively concerned with geometry and representation, nor to subscribe to the view that the problem of drawing is to get past its abstract character in favor of a more direct contact with the physical fabric of architecture. The capacities and logics of drawings are necessarily distinct from the potentials of construction. “Projection operates in the intervals between things. It is always transitive.”7 Following Evans, my method is to pay close attention to the transactions between the culture of drawing and discipline of building. The conclusion I draw from this analysis is that, difficult as it may be, the architect must simultaneously inhabit both worlds. Instead of reiterating fixed categories, what seems important today is to recognize the interplay of thought and reality, imagination and realization, theory and practice.

In his treatise on architecture Vitruvius had long ago pointed out that “architects who have aimed at acquiring manual skill without scholarship have never been able to reach a position of authority to correspond to their pains, while those who relied upon theories and scholarship were obviously hunting the shadow, not the substance.”8 Architecture proposes a transformation of reality carried out by abstract means. But the means of representation are never neutral, never without their own shadows.9 In the case of architecture, it is the ephemeral shadow of geometry cast on the obstinate ground of reality that marks the work of architecture as such.
Piero della Francesca, "De Prospectiva Pingendi", c. 1482
A dream is, among other things, a projection:
an externalization of an internal process.

Sigmund Freud

VISION AND PERSPECTIVE

In order for classical architecture to identify itself with the exact sciences, architecture had to establish its foundations in mathematical reasoning. Architecture could be scientific only to the extent that it was mathematical. In classical theory, perspective offered a geometrical means to order the constructed world in accordance with nature. Perspective linked the perception of the world to ideas about the world through the vehicle of mathematical reason. But perspective also functioned as a concept of time: ordering, surveying and recreating the past from the privileged viewpoint of the present. Just as the distant Roman past was rediscovered/reinvented on the basis of ruins and fragments, so the viewing subject could reconstruct the narrative space of painting by means of perspectival projection. Space is read in depth—locating the spectator in front of and in the present, from which the distance/past is entered and traversed. Perspective establishes a spatial field that supports narrative time.

The mathematical calibration of the visual world allowed other correspondences. The analogies between musical and proportional harmonics were established on the basis of their common foundation in geometry. Cosmological, religious, and philosophical consonances were played out on the basis of the geometry of space and its relation to an idealized body. Even emerging sciences of ballistics and fortifications could be given a metaphysical overtone by contact with geometry. Seeing was understood as a natural function of the eye; the paradigms of Renaissance painting naturalized an idealized concept of vision. As Erwin Panofsky has pointed out, perception and concept were unified in Renaissance perspective practices: "esthetic space' and 'theoretical space' recast perceptual space in the guise of one and the same sensation: in the one case that sensation is visually symbolized, in the other it appears in logical form." In architecture, the smooth space of mathematical reason allowed the architect to reverse perspective's narrative vector and project precisely imagined constructions into the future.

The constructions of perspectival geometry then, appear to enforce the privilege of the perceiving spectator. But Norman Bryson, elaborating on the speculations of Jacques Lacan concerning optics, has pointed out that the presence of the viewing subject implies a corresponding absence: "The moment the viewer appears and takes up position at the viewpoint, he or she comes face to face with another term that is the negative counterpart to the viewing position: the vanishing point ... The viewpoint and the vanishing point are inseparable." If, as Renaissance theory wants to suggest, the proper perspectival construction contains within it an ideal viewing distance, which fixes the position of the spectator, the spectator is at this moment also effaced. The viewer, in facing the vanishing point, is confronted with a "... Black hole of otherness placed at the horizon in a decentering that destroys the subject's unitary self possession." The very possibility of the subject's being in the picture is inextricably linked to its displacement from the picture.
In Albrecht Dürer's 1525 woodcut "Artist Drawing a Lute" the paradox of the viewing point, and its decen­tering effect, is underlined. Laid out perpendicular to the viewer's line of sight, a lute sits on a table to which a wooden frame has been attached. A hinged panel holds the drawing that is being produced. It has been rotated ninety degrees from the frame, which turns it toward the viewer, who can observe a series of points forming the outline of the instrument. A string attached to a counterweight is threaded through a metal "eyelet" on the wall behind the artist, while his assistant holds a stylus attached to the other end of the string. The assistant aligns the stylus to a series of points on the edge of the lute. By adjusting a pair of crossbars to mark the intersection of the string with the plane of the wooden frame, the artist transfers the series of points to their foreshortened location on the drawing surface. Through the repetition of this process, the three-dimensional form of the instrument is converted into a two-di­mensional projection. In this diagram, the viewpoint is represented by the mechanical eyelet attached to the wall. Leaving aside the problematic idea of replacing binocular vision of the human eyes with a single point, it is clear that in this construction, the viewpoint is an abstract location that can never be physically occupied. It is a geometric point, an imaginary location without dimension.

There is another interesting aspect to this diagram. The construction of the drawing is depicted as a mechanical activity. The gaze of the artist, for example, is directed not at the lute itself, and not from the imaginary viewpoint, but toward the point where the lines of projection and the picture plane intersect. That is to say, his attention is given over to the device itself and the mechanics of making the drawing. He pays little attention to its subject (the lute), and the viewpoint is actually behind his head. He moves around and over the scene of representation, but never occupies a place within it. Dürer has depicted these artists manipulating a physical framework, producing the drawing without relying upon their own visual perception. The physicality of this conceptual framework has led Jacques Lacan to remark: "The geometrical space of vision—even if we include those imaginary parts in the virtual space of the mirror...is perfectly reconstructible, imaginable, by a blind man." There is nothing in Dürer's dia­gram to contradict this. Every operation shown in the drawing could be carried out by a blind person.

Lacan's observation suggests that in codifying vision as perspectival geometry, the theorists of the Re­naissance missed out on the quality of visual perception itself. Dürer's woodcut, as a diagram of per­spective theory, confirms Lacan's assertion: "perspectival construction allows that which concerns

vision to escape totally." The agency of the viewing subject is short-circuited in the capture of the represented object. The act of representation is depicted as an objective, scientific activity—the recording of already established relations and facts. Perspective belongs to visuality (that is to say, the codes and conventions of the visual), and not to vision. Light and shadow, reflection and transparency, binocular and peripheral vision, all drop away as the object is converted into a linear abstraction. Yet, as could be abundantly demonstrated, the practice of painting in the Renaissance, while dependent on the theoretical scaffold of perspective theory, always exceeds its limitations. Moreover, in perception, perspective is more robust than its critics would have it. Pictures do not collapse, for example, when the viewer moves off the axis of viewing. The conventions of Renaissance painting are conventions, and not "natural" transcriptions of vision, and they collaborate with the viewer’s perception—which is itself a product of cultural formation—to form intelligible pictures.

To point this out is not so much to contradict Lacan, but rather to underline the role of the subject’s agency in the formation of the picture. That is to say, the picture is not objectively given in its construction, but formed in a complex interaction with the subject—both the perceiving subject and the creating subject. To suggest that any geometrical construction, no matter how complex, could be capable of mapping the fluidities of vision is always to artificially reduce the complexity of vision. "Perception eclipses structure," notes Lacan commentator Jacques-Alain Miller. Perspective apparently only indirectly concerns the visual. Yet, considered from its functional aspect—as an instrument to manipulate
space, which is not a tangible body but an abstract set of relationships—this may not be a liability. To what degree, for example, is musical notation concerned with the audible? Instead, similar to what Lacan calls "the geometrical space of vision," it is an abstract, and to some degree arbitrary series of notations that concern the internal structure of the work.

For Panofsky, it is precisely the ability to represent abstract space that distinguishes Renaissance art ("a perfectly unified world ... where bodies and the gaps between them were only differentiations and modifications of a continuum of a higher order") from the world of classical antiquity that "recognized as artistic reality only what was tangible as well as visible." Renaissance perspective implied a geometric order common to both bodies and space. Instead of tangible objects floating in measureless space, space itself can be measured and precisely represented. Although early theories of perspective are elaborated by architects such as Filippo Brunelleschi and Alberti, perspectival projection is not directly utilized in the construction of architectural space. It is rather that perspective as a conceptual schema underlines Renaissance architectural theories of perception and proportion. Renaissance practice confirms that design is not visualization (empirically "testing" successive versions) but rather the manipulation of a series of highly abstract devices—primarily the orthographic projections of plan and section—that serve to describe and construct space. In Brunelleschi's famous demonstration of perspective, the view of the baptistery as a freestanding object is represented by a drawing in perspective, but the sky, and by extension, the space that the object occupies, is brought into the picture by means of an illusion: a mirror that reflects the actual sky beyond the observer.

Could it be that what a practicing architect might reasonably ask for in a theory of representation is not a perfect match between the object and its representation, but rather to accept the impossibility of an accurate transcription of vision as a fundamental starting point? In other words, that the operative power of the system is precisely its abstract, structural character, and not its ability to transcribe, or fix something as ephemeral as visual perception. If geometry only incompletely maps perception, and if vision of necessity operates through the social, then the history of representation becomes a history of the forms of its mediation. Such a history would map both the resistance of geometry itself as material and the subject's always mediated and partial access to geometrical thinking. It would therefore come as no surprise that all representations are incomplete and fragmentary. The work of representation could be understood as a series of provisional strategies—necessarily abstract and intangible—to negotiate difference and work within the gap between vision and visuality. It would be possible to evaluate specific representational strategies for their differing instrumental utilities (and for their ideological or social implications) without obligation to accept or reject the system as a whole on the basis of the illusive criterion of "faithfulness to perception." Projection is not a thing in itself, but a relationship between things. As such, its internal relations are not fixed, and can always be reconfigured. And, it follows that the exercise of representation in architecture always necessitates an active effort of geometrical imagination, a mental and intellectual projection, like the translation of musical notation, to synthesize these always multiple and always incomplete representations: the complex process imperfectly referred to as "reading" drawings.
Besides, there can be no doubt that the perception of space is a complex phenomenon: space is perceived and represented indissolubly.

Roger Caillois

ANAMORPHOSIS — MONSTERS OR ABERRATIONS?

Perspective registers the distortion and foreshortening of a perceived object by tracing lines from its outline back to an imaginary viewpoint. The image is formed in the intersection of these lines and a picture plane—a screen perpendicular to the line of sight. But as a geometrical system, perspective construction does not always depend on a preexisting object. The "impossible" perspectives of Piranesi’s Carceri, (1760–61) for example, show that perspective is not limited to recording the form of already existing spaces or bodies, but can be employed to imagine new spaces or objects. Further, within the logic of the system of perspectival projection, there exists the possibility of its reversal: the system diagrammed by Dürer to represent an object can be turned around to produce the illusion of the presence of an imaginary object. A century before Piranesi, Athanasius Kircher, in his engraving “Application of the Magic Lantern” (c. 1660) shows how the geometries of projection might work to create the illusion of the presence of an object. In Mario Bettini’s “Reproduction of an eye by means of catoptric anamorphosis upon a cylindrical surface” (1642) the representation of the eye is multiplied into a series of projections, all more or less distorted.

The appearance in the seventeenth century of these apparent aberrations within projective systems marks an important shift in the understanding of perspective. Perspective in these cases is not under-
stood as a means to visually transcribe reality, but rather as a more or less coherent system that can be manipulated to produce distinctive results. Perspective is not presented here as naturalized vision, but as artifice and the construction of illusion. These "artificial" uses of projection in turn coincide with the more secure mathematical and technical bases for projection established in the late sixteenth and early seventeenth centuries. The codification of the principles of stereotomy by Philibert de l'Orme (Le Premier Tome de l'Architecture, Paris 1567) and the establishment of generalized principles of projective geometry by Girard Desargues (published in Abraham Bosse, Manière universelle de M. Desargues pour pratiquer la perspective, Paris 1648) demonstrate the interconnection of instrumental and scientific research on projection. The first systematic descriptions of axonometric (or parallel) projection also occur in the late sixteenth century. The emergence of calculus and analytic geometry in the seventeenth century made it possible to see graphic data not as a more or less accurate approximation of sight, but as a way of calculating and predicting abstract quantities or behaviors. The discoveries of projective geometry had applications in a wide variety of fields such as astronomy, navigation and mapmaking not necessarily connected to the discourses of esthetics or representation. The aberrations of anamorphosis and the mathematical development of projective geometry, although apparently incompatible, represent different aspects of a generalized science of projection emerging in the seventeenth century. Once projection has been detached from its imperative to transcribe vision, it can be utilized as an instrumental technique equally capable of producing instrumental data or apparently irrational effects.

But from the point of view of the techniques of drawing, the changes introduced are relatively minor. In anamorphic projection, for example, all of the essential elements of perspectival construction are still present: the object (imagined or real), the viewpoint, the screen, and the converging lines of projection are all present. A series of small technical adjustments produces a major disruption. Sim-
ply tilting or warping the screen of projection in Dürer's diagram, for example, would have the effect of introducing a similar distortion into the image. By calling attention to the exaggerated distortion of the anamorphosis, the viewer is made aware that all perspectives depend upon distortion. The effect is to make the construction visible. The artifice is no longer hidden, and perspective can no longer be understood as the natural outcome of vision. The evidence of disorder (distortion, dissonance) is contained within the rational limits of the system itself.

I might even go so far as to propose that it is anamorphic projection that is the more general case, and that perspective could be understood as a special case of anamorphosis. In this sense it might be possible to speak of a generalized system of projection utilizing vanishing points, converging projectors and picture planes, which, when aligned, produce "correct" perspective views, but when placed in different relationships, produce "distorted" anamorphic effects. As such, anamorphosis functions to make visible the limits of the perspectival system and its arbitrariness. A legitimate exercise of the established rules of the system has the capacity to produce monsters and aberrations. Anamorphosis makes explicit the subject's agency in viewing. It confirms that viewing itself involves projection and participates in the construction of the illusion. Projection as active construct connects the history of representation forward in time to the apparatus of the cinematic camera and projector, which also operate to construct animated illusions by means of projection.

Like conventional perspectival construction, anamorphosis locates the viewer, but now in an oblique and decentered position. The image coalesces only in the moment of turning away from the painting. The geometrical character of vision is used in order to capture the subject. Lacan calls anamorphosis a "trap for the gaze:" in turning away, the viewer sees that which is hidden in the construction of the picture; at this moment, the contingency of the act of viewing, and the collaboration of the subject's desire, is underlined. The subject is always in the picture. For Lacan, the discussion of anamorphosis confirms that Euclidean geometry is inadequate to map the complexities of perception and the fluidity of the gaze. The constructions of subjectivity always exceed their geometrical description. If projection is no longer understood as natural, scientific and objective, but as the product of active subjectivity and the construction of illusion through "irrational" means, what are the consequences for architectural practice?
In fact no one can imagine or project anything modern. By definition there exists an essential contradiction between the terms "project" and "modern." To project literally means to throw forward. But in order to throw something forward both thrower and projectile must be behind. Every project is an emissary from the past.

Josep Quetglas

AXONOMETRIC PROJECTION:
NEW GEOMETRIES AND OLD ORIGINS

In 1925, El Lissitzky writes: "In the period between 1918 and 1921 a lot of old rubbish was destroyed. In Russia too we have torn A. [art] from its holy pedestal while spitting on its altar." For these revolutionary artists, the old forms of representation could no longer hold together under the pressure of sustained innovation. "Perspective," Lissitzky writes, "limits space; it has made it finite, closed." The world is put into a cubic box, which creates a static "facade view" of the world. Suprematism, on the other hand, "has extended the apex of the finite visual cone of perspective into infinity ... It has broken through the blue lampshade of the heavens." In Lissitzky's "irrational" space, viewpoint and vanishing point are both located at infinity. The infinite extension in depth coincides with the suspension of the subject's privileges of self-location. The viewing subject and the object of representation both inhabit the same extended field. Projection operates to simultaneously extend and collapse distance: "Suprematist space can be formed in front of the surface as well as in depth. [...] Suprematism has swept away the illusion of three-dimensional space on a plane, replacing it with the ultimate illusion of irrational space with attributes of infinite extensibility in depth and foreground."24

Perspective and anamorphosis, despite their nature as mathematical constructions, are still essentially pictorial, and work in the symbolic register. Perspective, while aspiring to be scientific and generalizable, was always linked to a fixed point of view. By extending the vanishing point to infinity, the constructions of perspective are rendered at one and the same time more flexible from an instrumental point of view, and more universal from a philosophic point of view. These revolutionary artists of the early twentieth century wanted to go beyond art's traditional role of interpreting the world to imagine an art capable of constructing new worlds. Hence the attraction of axonometric projection. Axonometric, because it could transmit abstract information, and because it was measurable and precise, was the ideal tool to delineate the avant-garde vision of a new world.25 Perspective records what already exists, whereas axonometric constructs that which does not yet exist.

Yet, in the approach of Lissitzky, as in other early twentieth century abstract painters (or as they were sometimes referred to, "non-objective" artists—Kazimir Malevich, Wassily Kandinsky, or Piet Mondrian,
El Lissitzky—Frontal and Oblique Views of El Lissitzky’s 1923 Proun, Reconstruction by Author

for example) a curious contradiction emerges. On the one hand, Lissitzky wants the progress of the visual arts to be understood as a parallel to scientific and mathematical progress. The objectivity of science counters the traditional concept of the artist as mystic, or seer. The modern artist, by contrast, constructs a new reality with scientific means, rather than interpreting an existing reality on the basis of existing conventions. On the other hand, Lissitzky wants to preserve art’s privileged capacity to make visible the infinite and the immeasurable—the traditional realm of the spiritual. Lissitzky accomplishes this “knight’s move” by appropriating devices from the technical disciplines. Mechanical drawing, optics, and ballistics are attractive to Lissitzky for their objectivity and technical precision, that is to say, modern and progressive from a scientific point of view. But these instrumental techniques are given a new meaning in the context of avant-garde practice. For these artists, the visual abstraction of these techniques—the indeterminacy of the represented spatial field—becomes primary. Instrumentality may work against the symbolic, but a new metaphysics of infinite space works against the instrumental. A symbolic dimension is grafted onto these technical practices.

Axonometric has its origin in ancient visual practices, and Massimo Scolari has argued for a history of continuous development of parallel projection alongside of perspectival projection. Parallel projection appears whenever questions of measurability, prediction and verifiability arise. Therefore it is not surprising that the earliest systematic description of axonometric projection occurs in the context of military use, where it was utilized to chart the three-dimensional trajectory of artillery projectiles. In the eighteenth and nineteenth centuries, axonometric drawing was taught in engineering schools and its development and dissemination was closely related to mechanization and industrialization. The use of axonometric projection in architecture extended the scientific/mathematical basis for architectural representation already initiated with the widespread teaching and use of descriptive geometry. It is a history linked more closely to the École Polytechnic than to the École des Beaux Arts. For these architects or technical draftsmen, axonometric combined the immediacy of a perspectival view with the
measurability and transmissibility of orthographic projection. Axonometric projection, originating in the abstract and instrumental world of the technical disciplines, does not pretend to map vision. It is concerned instead with construction and consistency of measurement.

The technical difference between perspective and axonometric is the absence of a vanishing point. Instead of converging, as they do in perspectival projection, the projectors in axonometric projection are parallel, as in the orthographic projections of plan and section. One way of describing this condition mathematically is to say that the vanishing point is located at infinity. And this was precisely what attracted abstract artists such as Lissitzky: the capacity to make the infinite visible in the context of a quasi-scientific construction. These non-objective artists were not interested in distortion, but in ideal geometries and universal applicability. They were fascinated by the reversibility of the spatial field in axonometric, which seemed to render space extensive. Axonometric projection was an ideal device to represent universal geometries and infinite space. These artists suggested by implication that axonometric, although originally derived from the technical disciplines, may simultaneously map a new condition of vision—a modern condition of vision marked by the fundamental abstractness of technology and the universal geometries of mathematics.

![El Lissitzky, Schema from K. und Pangeometrie, 1925, Redrawn by Author](image)

It was not only infinite space that was made visible in axonometric projection, but also new concepts of time. If perspective, dependent on a fixed point of view, seemed to freeze time and motion, the atypical space of axonometric suggested a continuous space in which elements are in constant motion. The same property that made axonometric such a useful tool in explaining the construction of complex machinery or spaces, (which could be represented in "exploded" form, and reconstructed in the imagination by moving the elements into place on the parallel projectors), could be exploited here to suggest the simultaneity of space and time. The reversibility of the spatial field allowed for the simultaneous presentation of multiple views. The suspension of the viewing subject shifts attention to the constitution of the object itself, suspended in time in an ambiguous spatial field. Distanced from the viewer (who, in axonometric projection is usually located not in front of, but above or below the object), the represented object can be freely rotated, dismantled or reconstructed. Axonometric and technical drawings lend themselves to the multiplication of views in an effort to describe the complex totality of the object.
For these avant-garde artists, axonometric projection approached something like what philosopher Edmund Husserl identified as geometry's "ideal objectivity":

The Pythagorean Theorem, indeed all of geometry, exists only once, no matter how often or even in what language it may be expressed. It is identically the same in the "original language" of Euclid and in all "translations," and within each language it is again the same, no matter how many times it has been sensibly uttered, from the original expression and writing down to the innumerable oral utterances, or written or other documentation.

Writing in 1936, Husserl signals the special capacity of geometric concepts to exist independent of any particular representation. Geometry's objects are "ideal objects," given as concepts, and distinct from both scientific instrumentality and the vagaries of the individual subject. Geometry, for Husserl, exists prior to history, local circumstance or any particular instance of its expression. Husserl's project, seen in the historical context of the 1930s, is in some sense parallel to the theoretical project of those early modernists who also sought new paradigms of representation in order to renew contact with the "origin of geometry."

For Husserl, geometry is indifferent to translation. Its origin is always present and its ideal objectivity is unaffected by the particularity of utterance or the language of its expression. There is nothing lacking for translation to supplement, no difference to be put into play. This perfect transparency is not uncontested; Husserl is fully aware that it necessitates a bracketing of the contingencies of language and practice to achieve such ideal objectivity. As opposed to the multiplication of languages and the splintering of signs (what he refers to as the "seduction of language") Husserl looks for a notion of language grounded in universal geometries and ideal formations. He would use geometry as a model for language, not language as a model to describe geometry. Husserl's dream is of a return to language in general, and a series of ideal formations capable of
universal intelligibility: "geometrical existence is not psychic existence; it does not exist as something personal in the personal sphere of consciousness: it is the existence of what is objectively there for 'everyone' (for actual and possible geometers, or those who understand geometry)." He wants to rescue geometry, as something full of meaning, from instrumentality that he sees in the unreflective employment of geometry in technical pursuits.

Hence, for Husserl, it is precisely the abstraction of geometry—its lack of specific meaning—that makes it possible to be objectively available "out there" to everyone. But for Husserl, as for the non-objective artists of the early twentieth century, abstraction does not signify a move away from meaning, or a shift toward instrumentality, but rather a turn toward a deeper meaning. Husserl underlines the universality of geometrical practices: "Measuring belongs to every culture," he writes, suggesting that geometrical thinking is beyond convention and cultural difference. And there is a correspondence at the level of formal esthetics as well—ideal objectivity favors regularity of expression: "straight lines are especially preferred, and among the surfaces the even surfaces... Thus the production of even surfaces and their perfection (polishing) always play a role in praxis." The esthetic vision that corresponds to Husserl's dream of a universal objectivity tends toward the elimination of imperfection and the smoothing out of difference: think of the abstract canvases of Piet Mondrian, or the polished surfaces of Constantin Brancusi's sculptures.

Architecture tends, in theory, toward Husserl's ideal objectivity. Yet in practice this perfect smoothness proves unattainable. The abstraction of architectural drawing is as much a product of its instrumentality as a result of contact with the origins of geometry. Architectural representation makes use of Husserl's geometric transparency, and is indeed marked by it, yet its objectivity can never be perfect. Architectural drawings always maintain some contact with instrumentality. Architecture as a pure mathematical construction remains a utopian dream. In most early modernist architectural practice, axonometric maintains the linearity and objectivity—the measurability—of the architect's plans, and it is therefore attractive to architects such as Hannes Meyer or Walter Gropius not for its "irrational" qualities but for its objectivity. Transparency here implies not privileged contact with origins (Husserl) but a guarantee of technical performance. Axonometry as a useful means of explaining complex architectural objects needs to be distinguished from axonometry conceived as a privileged means to represent complex new spatial effects.

Even in the case of an abstract artist such as El Lissitzky, the smooth space of axonometric projection works against multiple resistances when translated into three dimensions. If we compare the implied space of the Proun drawings with the 1923 Proun Space, it becomes evident that the infinite extension of the visual field is more present as representation than as experience. The "metaphysics of infinity" can only be incompletely realized. Lissitzky maintains art's privilege of "ultimate illusion" in the three-dimensional space. The Proun Space is still a representational device, a construction suggesting something beyond itself. The spatial indeterminacies of the two-dimensional Proun drawings
Hannes Meyer + Hans Wittwer—Drawings for Peterschule, Basel, 1927
are not put into play, releasing new dimensions, but rather reduced to a series of shallow sculptural reliefs set against the stable rectilinear frame of the room. Modifications have been introduced, but the basic framework of Euclidean geometry is untouched.\textsuperscript{35} The classical symbolism of measurable figurative space is exchanged for a new symbolism of infinite abstract space. The appeal to mathematics as transcendental and foundational is not diminished.\textsuperscript{36} The stable coordinates of Cartesian space persist, now as a framework for viewing a fragmented object. The privilege of the viewing subject is maintained. The double metaphysics of early modernism—infinite space and simultaneous time—is available only as metaphor.\textsuperscript{37}

Although complex spatial effects of ambiguity, transparency or reversal are evident in the experience of early modern buildings, these effects are not always directly anticipated in the form of drawings. The distance between Theo van Doesburg’s axonometric projections and his realized constructions, the decoration of the \textit{Café Aubette} (1927), for example, rehearse the same difficulty of translation described in the case of Lissitzky. Neo-plasticism wanted to identify the atypical space of axonometric with a new sense of an infinite spatial field. These artists and architects proposed a utopian esthetic that could extend to all aspects of urban and everyday life. But it became increasingly difficult to reconcile that esthetic vision with the experience of the spectator in concrete physical space. The reinterpretation of axonometric projection by avant-garde artists, as a vehicle for universal, abstract thinking, was never fully integrated into architectural practice. As Yve-Alain Bois has pointed out,\textsuperscript{38} it is only in more recent practice—the projections of Daniel Libeskind or the axonometric models of Peter Eisenman, for example, where an investigation of the means of representation takes precedence over realized buildings—that architects have fully exploited the implied reversibility of depth and foreground that characterizes axonometric projection. But in this case the representations can only refer to other representations. This work (even when constructed) remains locked within a limited scope of problems specific to the discipline of architecture, and its own internal history. It is incapable of taking advantage of the instrumental capacity of architectural projection to transform reality and thereby, of necessity, to engage the social.
Peter Eisenman——Model, House X, 1978

OVERLEAF——Sergei Eisenstein——Score for Alexander Nevsky