

## CUBISM AND THE FOURTH DIMENSION: A MYTH IN MODERN CRITICISM

Everyone who has anything to do with modern art recognizes the importance of Cubism, an importance that goes beyond the quality of individual pictures and resides in their bearing on the entire tradition of the past. Cubism not only changed the face of art for all the coming generation, it did so with a suddenness unprecedented in the history of artistic innovation. All other movements of so extreme a character had taken at least the lifetimes of two or three artists to accomplish their aims. Cubism became at once the most influential movement on the continent; within a decade it had run its course and made its impact. Nothing in the arts can compare with it. Still, it is not altogether singular.

If one wishes to find a parallel to Cubism in the sense of a productive force in revolutionizing a field of intellectual endeavor he will find the closest thing to it in modern physics. Moreover, the new physics resembles Cubism in its apparent inevitability; it is possible to suppose that both the painting style and the Theory of Relativity would have been invented whether the

## *Cubism and the Fourth Dimension*

geniuses Picasso and Einstein had happened on the scene or not. Dozens of people were working in precisely those directions at the time. Furthermore, “many analogies have been drawn between Cubism and modern science, between the ‘simultaneity’ of vision (or shifting points of view) Picasso and Braque applied to nature, and space time physics.”<sup>1</sup>

As it happens those analogies are as specious as they are ubiquitous. They misrepresent both Cubism and modern physics. Because they emerge with great frequency in the contexts of cultural history and art criticism—pretending to serve as unitary principles of modernity—it is important that some energy be devoted to discrediting them. In order, however, to give a somewhat comprehensive coverage of the typical absurdities that are appanages of critical thinking about Cubism it might be advisable to discuss the matter in terms of the notion of a “fourth dimension.”

The term “fourth dimension” has a very unique history. Supposed by many to be part of the esoteric vocabulary of contemporary science and only that, the term is as well a household word among many non-scientific groups connected with very exotic varieties of speculation. It was invented during the seventeenth century by an Englishman, Henry More, the most mystical of an obscure group of philosophers known as the Cambridge Platonists. In his *Enchiridion Metaphysicum* More proposed a fourth dimension as the realm necessary for the Platonic Ideal to occupy.<sup>2</sup> Given this curious background it is not at all surprising that the term and the idea should have been cordially welcomed by an intellectual curiosity of recent times known, variously, as “psychic science,” “spiritualism,” and “the lunatic fringe.”

The most interesting, not to say bizarre, turn given the geometry of higher dimensions was in the 1870’s by the Leipzig astronomer Zöllner. He was interested in the “experiments” of an American medium named Slate who claimed direct intercourse with the spirit world and whose exhibitions consisted of causing

<sup>1</sup> Sam Hunger, *Modern French Painting* (New York, 1956), p. 194.

<sup>2</sup> See Robert Zimmermann, *Henry More und die vierte Dimension des Raumes* (Vienna, 1881), *passim*.

objects to disappear and reappear. To account for these phenomena the astronomer propounded a pseudo-mathematical theory that has come to be universally accepted by spiritualists, mediums and, most recently, by the “flying saucerists.”

He postulated that for the real physical phenomenon there is really a space of four or more dimensions, of which we, because of our limited endowment, can appreciate only a three-dimensional section  $x_4=0$ . He argued that an especially gifted medium who, perhaps, is in touch with beings living outside this world of ours, can remove objects from it, which would then become invisible to us, or he can bring them back again. He attempts to make these relations clear by picturing beings who are restricted to a two-dimensional surface and whose perceptions have this limitation. We may think of the mode of life of certain animals, e.g. mites. If an object is removed from the surface on which these creatures live, it would appear to them to disappear entirely (that is how it is conceived) and it was in an analogous fashion that Zöllner explained Slate’s experiments.<sup>3</sup>

The idea that Cubism might have something to do with the fourth dimension was broached very early by Guillaume Apollinaire, the poet and champion of *avant garde* art, who asserted this in a lecture in 1911<sup>4</sup> and in a little book on Cubism later on.<sup>5</sup> One might assume that Apollinaire, whose writing could never claim clarity as a virtue, was using the term “fourth dimension” metaphorically, in the way Susanne K. Langer uses “virtual space” to describe a space that is not the space of the world of conventional magnitude and yet has a sense of form and reality nonetheless.<sup>6</sup> From his words it seems far more probable that he was speaking of Cubism as an artistic formulation of Zöllner’s theories, that is, as a depiction of a spatial realm not accessible to the ordinary senses.

Whether or not Zöllner and Apollinaire were correct about dimensionality and Cubism respectively no one but a genuine

<sup>3</sup> Felix Klein, *Elementary Mathematics from an Advanced Standpoint*, vol. II, trans. Charles A. Noble (New York, 1939), pp. 62-63.

<sup>4</sup> See Edward Fry, *Cubism* (New York, 1966), p. 119.

<sup>5</sup> Guillaume Apollinaire, *Les Peintres Cubistes* (Paris, 1913), p. 25.

<sup>6</sup> Susanne K. Langer, *Feeling and Form* (New York, 1953), *passim*.

## *Cubism and the Fourth Dimension*

medium could guess. For the ordinary person it is an open—if curiously irrelevant—question. The other variation on the dimensionality theme, however, has to do with the Theory of Relativity and thereby stakes a claim to the absolutely monumental prestige of the principal scientific development of the twentieth century.

For people already familiar with the notion of the fourth dimension as an invisible set of relations it was only a short step to the idea of temporality as a fourth dimension. The development of the four-dimensional space-time world of modern physics afforded the opportunity to take that step. As it happened, it was a mis-step, but the direction was very, very appealing. That can be seen in the work of one of the most popular novelists of the modern era.

In 1895 H. G. Wells introduces us to a fashionable dinner party where “the fire burned brightly, and the soft radiance of the incandescent lights in the lilies of silver caught the bubbles that flashed and passed in our glasses.”<sup>7</sup> One of the group is the so-called Time Traveler who sets out to controvert some ideas that are almost universally accepted. He begins by arguing that a mathematical line, a line of nil thickness, has no “real” existence (in the prosaic, as opposed to abstract, sense). All present agree. Nor, he says, has a mathematical plane. Again, agreement all around. Neither, then, he proceeds, can a cube which has only length, breadth and thickness have a real existence. At this, of course, they protest. But, Time Traveler urges, can an *instantaneous* cube exist? “Clearly,” he goes on, “any real body must have extension in four directions: it must have length, breadth, thickness *and* duration... There are really four dimensions, three of which we call three planes of space, and the fourth, time.”<sup>8</sup>

Thus, by the end of the nineteenth century, serious fiction as well as pseudo-scientific writing had prepared a certain segment of the reading public to accept the idea of time as a dimension. And the appearance of the space-time world of modern physics confirmed in these people’s minds the justice of the notion.

The historical background of the idea of time as a dimension in

<sup>7</sup> H. G. Wells, *The Time Machine* (New York, 1932), pp. 3-4.

<sup>8</sup> *Ibid*

science begins with the Michelson-Morley experiments which attempted to establish the velocity of light through a hypothetical "ether," involves the theoretical merit of the theories of Einstein and the value of the hypotheses of Lorentz and, all in all, is extremely technical both in conception and lineage. Suffice it to say that the *popular* (and mistaken) view of space-time is embodied in the casual statement: "Time is the fourth dimension of space." That view assumes that the prosaic or historical meaning of time as past, present and future states is destroyed. It holds, in other words, that time in the sense of duration or of a sequence of moments is an illusion. In this respect time is viewed similarly to Zöllner's mysterious fourth dimension. In effect, all that has ever happened or ever will happen is presumed to have occurred simultaneously. Thus everything is, from the classical standpoint, coexistent; it is only because we perceive of it in segments that we say "time passes." Time, metaphorically speaking, is a yardstick, a given space; some people (e.g., Nero) are at  $3\frac{3}{4}$  inches, others are at 15 inches, and so on and so on. Of course, since no one can see the yardstick at all except as he moves on it we quite naturally term our sequence of perceptions "temporal."

The above description may take the popular notion of simultaneity seem slightly more ridiculous than it actually is, but it is set down here in its most adumbrate and least elaborate form. Actually, the bare skeleton of this conception is very ancient—at least as old as Zeno (335-265 B.C.) who composed the famous paradoxes to prove that time and change are illusory.

The idea that the scientific conception of simultaneity has something to do with both prosaic dimensionality and Cubism seems to have become more and more assimilated into thinking about the art of the period since the time it was first expressed. For example, so justifiably respected a critic as Sigfried Giedion talked about it in his famous Charles Eliot Norton Lectures during 1938 and '39.

Cubism breaks with Renaissance perspective. It views objects relatively: that is, from several points of view, no one of which has exclusive authority. And in so dissecting objects it sees them simultaneously from all sides—from above and below, from inside and outside... Thus, to the three dimensions of the Renaissance which have

## *Cubism and the Fourth Dimension*

held good as constituent facts throughout so many centuries there is added a fourth one—time... The presentation of objects from several points of view introduces a principle which is intimately bound up with modern life—simultaneity. It is a temporal coincidence that Einstein should have begun his famous work, *Elektrodynamik bewegter Körper*, in 1905 with a careful definition of simultaneity.<sup>9</sup>

One finds this also in Kahnweiler's 1920 essay *The Way of Cubism*.<sup>10</sup> And precisely the same interpretation recurs all through Moholy-Nagy's influential design text *Vision in Motion* of 1947.<sup>11</sup> It appears to have been an article of faith with the Bauhaus.

Giedion's opinion, however, had been expressed in a much more explicit way in an article written by the minor Cubist, Metzinger, very early in the century and hinted at in the book *Du Cubisme* by him and Gleizes later on.<sup>12</sup> His idea was to justify the Cubist method of drawing with the new physics by attempting to show that Cubism, while apparently irrelevant to reality did, in fact, present a truer picture of things because it represented time as the new theories did, as a dimension. According to Metzinger, what the Cubist did was to present as simultaneous, successive moments of vision.<sup>13</sup> The view has become increasingly fashionable since and is, indeed, a cliché of contemporary criticism.

Curiously enough, there has been from the very first a tendency to apply the ideas of physics to Cubism without any attempt to "check out" either the ideas themselves or their applications. And as a flagrant falsehood is perpetuated it begins to sound more and more reasonable since it is met with more and more often.

Now, one has only to examine Cubist painting by its major practitioners to observe that their forms could not possibly have been arrived at by the procedure outlined by Metzinger. No conceivable superpositioning of the given objects would produce

<sup>9</sup> Sigfried Giedion, *Space, Time and Architecture* (Cambridge, 1941), p. 357.

<sup>10</sup> Daniel Henry Kahnweiler, *Der Weg zum Kubismus* (Munich, 1920), pp. 29-31.

<sup>11</sup> L. Moholy-Nagy, *Vision in Motion* (Chicago, 1947), pp. 113-128, 266.

<sup>12</sup> Albert Gleizes and Jean Metzinger, *Du Cubisme* (Paris, 1912), p. 13.

<sup>13</sup> Jean Metzinger, "Cubisme et tradition," *Paris-Journal*, 18 August 1911; trans. in Edward Fry, *Cubism* (New York, 1966), pp. 66-67.

a *Ma jolie* unless the fractioning of those elements were carried out to an extremity altogether uncalled for by the explanation. In fact, a Cubist image is made up not of elements of fractured objects but, instead, is built from fragments of elements. That is to say, one does not discover there a piece of a vessel, a segment of an eyeball, a part of a table; one finds instead no more than the lines and strokes that might represent such things were they brought into other relationships.

As a style, Cubism begins and ends with the assumption that nature and art are two utterly dissimilar phenomena, the one absolutely accidental and informal, the other rigorously formal and self-sufficient. In this it is the summing up of all that had been present in the hygienic, detached art of Georges Seurat and represents the furthest extension of Paul Cézanne's preoccupation with completeness and order. It is the first non ornamental painting to represent nothing but itself, to assume that a painting is only a painting just as a building is a building, and that a picture ought look no more like a segment of real space than a house ought to resemble a baker's roll.

Still, what is most peculiar about Metzinger's theory, in view of its prominence, is that at the very time he was propounding it, Einstein was proving the impossibility of establishing the simultaneity of any two events that do not occur approximately, that is, side by side. So far as the special theory of relativity is concerned, the sole difference between it and classical science lies precisely in Relativity's *denial* of the absoluteness of the simultaneity of spatially separated events. Therefore, had the Cubists really been consistent with the new developments in physics they would have demolished simultaneity! After all, the presentation of simultaneous images had been common practice in architectural and machine drawing since the Renaissance, by way of elevations and projections which showed at once the top, side and front of an object.

What, then, is meant when a scientist says that time is the fourth dimension of space? It means that he is speaking very loosely; what he should say is: "Time is a fourth dimension of the space-time world," or, more exactly: "Time is one of four space-time parameters in a physical theory." And what he then means has to do with mathematical expressions exclusively, for

## *Cubism and the Fourth Dimension*

the Theory of Relativity sought to resolve all distinctions as to determinations of temporality and position into the unity of purely numerical determinations:

The particularity of each "event" is expressed by the four numbers  $x_1, x_2, x_3, x_4$ , whereby those numbers among themselves have reference to no differences so that some of them  $x_1, x_2, x_3$ , cannot be brought into a special group of "spatial" coordinates and contrasted with the "time" coordinate  $x_4$ ... The direction into the past and that into the future are distinguished from each other in this form of the concept of the world by nothing more than + and - directions in space, which we can determine by arbitrary definition.<sup>14</sup>

What has happened is that the concept of an inertial system has been displaced by that of a field which depends on the concept of the total field that Einstein said is "the only means of description of the real world":

The space aspect of real things is then completely represented by a field, which depends on four coordinate parameters; it is a quality of this field. If we think of the field as being removed, there is no "space" which remains, since space does not have an independent existence.<sup>15</sup>

The author is no less aware than his reader that a thorough understanding of these matters presupposes a more than rudimentary grasp of the calculus. The point, though, is that that particular attainment is quite unnecessary to an understanding of Cubism. Surely, it must be obvious to any careful reader that the space of painting cannot accommodate the field concept of modern physics; those two things have nothing in common. What is more, the paintings do not represent such a concept symbolically. The fragmentations of Cubist art did not derive from simultaneous presentations of shifting points of view, but even if they had they would be unconnected with the Theory of Relativity. Thus, it can be argued that the entire notion of a hermetic connection between Einstein's theory and Cubism is false.

<sup>14</sup> Ernst Cassirer, *Substance and Function; Einstein's Theory of Relativity* (New York, 1933), pp. 448-449.

<sup>15</sup> Albert Einstein, *Generalization of Gravitation Theory*, Appendix II, from *The Meaning of Relativity* (Princeton, 1953), p. 163.



There is an interesting—if not astonishing—footnote to all of this. In the Spring, 1966, issue of the *Art Journal* Professor Paul Laporte published an article entitled “Cubism and Relativity.”<sup>16</sup> In it he presented more—or—less the position I have been attacking in these pages. And it was a position that he had stated previously; in 1948 and ’49 Professor Laporte had taken the same line in two essays.<sup>17</sup> And during 1945 he had done what no other writer on art seems to have had the nerve to do. He actually sent the manuscripts to Albert Einstein for his opinion. In the most recent article he makes public an epistle from the genius of modern physics.

Well, what did Einstein say? His letter to Laporte opens with the words, “I find your comparison rather unsatisfactory.” Then, after a very generous explanation of his own sense for some real connection between art and science, Einstein wrote: “Now, as to the comparison in your paper, the essence of the Theory of Relativity has been incorrectly understood in it, granted that this error is suggested by the attempts at popularization of the theory.” He then says pretty much what has been said here regarding the theory and closes with the comment that “this new artistic ‘language’ has nothing in common with the Theory of Relativity.”

And what is Laporte’s reaction to these apparently devastating remarks? Something of it may be surmised from the fact that he published his papers in spite of them. He first asks whether it is true that a scientific work like the Theory of Relativity can be understood only by specialists. And, of course, he answers that non-specialists *can* understand it. He then goes on to say that it seems to him that he can intuit more of the general significance of the theory because of his familiarity with Cubism! Were it not for Professor Laporte’s self-restraint and obvious good sense in other connections one would be forced to conclude that here is an outstanding instance of human vanity gone far astray.<sup>18</sup> In fact,

<sup>16</sup> Paul M. Laporte, “Cubism and Relativity,” *Art Journal*, Vol. XXV, No. 3 (Spring, 1966), pp. 246-248.

<sup>17</sup> Paul M. Laporte, “The Space Time Concept in the Work of Picasso,” *Magazine of Art*, Vol. 41, No. 1 (January 1948), pp. 25 ff. and “Cubism and Science,” *The Journal of Aesthetics and Art Criticism*, Vol. VII, No. 3 (March, 1949), pp. 243 ff.

<sup>18</sup> Laporte quotes a statement from Morris Davidson who says that Henri Bergson’s ideas of relativity preceded Einstein’s. (The fact that Bergson once

## *Cubism and the Fourth Dimension*

he is the victim of a fashionable belief that is based on false history and worse science. The belief is every bit as common as it is wrong, and it is the purpose of this paper to discredit it.

It is not the purpose of the paper to suggest an alternative. Cubism has nothing to do with the Theory of Relativity and that is the end of the matter. To argue this, however, is not to assert the absence of any significant relationship between the painting style and modern science—or, more definitively, between Cubism and the total culture to which science has contributed to vast and influence. The prominence of a belief in some kind of hermetic geometry associated with the paintings done between 1909 and 1913 is inescapable and must somehow be accounted for. It is due, most probably, to the sheer appearance of the analytical Cubist works which, in their typical form, are possessed of a peculiarly uncanny space.

Confronted with a mature Cubist canvas the viewer is often unable to establish the position of forms in space; a form may lie both ahead and behind another plane or line. The ambiguity is not due to a transparency of shapes—to some curious crystallinity—but, rather, is the product of the arrangement of continuities and discontinuities. Lines are prolonged through planes, edges vanish before they intersect other edges. All this makes for an unclarity of relations among the parts of the picture and the resulting space becomes highly elusive. The space of such pictures is simply not within the tradition of overlapping planes. And it is all the more fascinating for being at one and the same time indefinable and concrete. While we cannot refer to the picture plane as a screen behind which objects appear to exist, neither can we say that the picture is merely frontal, for at times the space appears even to protrude out into world. There is something here far more complex in its meanings than the old counterchange devices of the pattern-making arts in which figures, like the

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commented that his *durée* and Einstein's time had no connection seems to be overlooked). Laporte remarks, gratuitously, that he believes "the closest analogy to Bergson may be found in Van Gogh." Perhaps. But for what it's worth, Bergson revealed, during the course of an interview with Jean Wahl, that his favorite picture was Velasquez's *Spinners* because of the rendering of the moving wheel. For him it demonstrated that an object in motion is in a different state of existence than one at rest.

squares on a chessboard or the stripes of the zebra, are constantly competing with their backgrounds. Briefly, Cubism amounts to a maximization of the unordered set or series; it is a glorification of the non *a priori* constructions of Paul Cézanne.<sup>19</sup> That aspect of the style has surely inspired a great deal of far-fetched speculation about its connection with seemingly mysterious inventions in the narrow regions of thought with which art historians are normally unfamiliar.

Cubism, in separating the mode of representation from the nature of the things depicted, aligned itself with parallel views of human creativity reflected throughout the culture of the early century. In literature and music James Joyce, Gertrude Stein, E. E. Cummings, Arnold Schoenberg, Igor Stravinsky all came to regard the languages of their arts as having no privileged structure or preordained pattern at all. Finally, the realm of theoretical clarities offers a close parallel to Cubism not in physical science but in modern logics developed by Russell, Hilbert, and Brouwer. They, too, separate the mode of representation from the things represented. In this light Cubism may be considered not simply a style that lasted for a few years among a number of painters but can be interpreted as part of a more general tendency in twentieth-century life towards the “construct” that is sufficient unto itself and not associated with nature or with any emotion that is unrelated to the aesthetic experience of man confronted by man’s creations.

The ability to see forms as non-discursive is one of the most remarkable things about contemporary living. It allows us to look at all the world of art as a range of instances, to respond to all works of art in terms of their formal structures without any knowledge of their meanings. Picasso’s genius is the highest manifestation of this attitude, the development of his art one of its clearest manifestations.

<sup>19</sup> See Fritz Novotny, *Cézanne und das Ende der wissenschaftlichen Perspektive* (Vienna, 1938), *passim*.