

The Art of Truth: Comparing Mathematics to the Discipline of Painting

I. Introduction

When I tell people that I am a mathematics major and a studio art minor, overwhelmingly the response I get is one of surprise that I have chosen such a strange combination of disciplines. "They're so different from each other!" people exclaim. Mathematics is often considered a "left-brained" discipline, logical and linear in its structure, and art a "right-brained" activity, stirring one's intuition and encouraging spontaneity and unpredictability. As a student of both disciplines I experience some sort of intrinsic enjoyment when these stereotypical conceptions of each are contradicted. This occurs with surprising frequency. For example, it takes creativity to conceive of a geometry where the degree sum of a triangle is strictly less than 180 degrees, and the transference of what an artist sees in three dimensions to a two-dimensional canvas takes a surprising amount of discipline and logical strategy. To a further extreme, I am always intrigued and excited when art and mathematics seem to connect or overlap. While there is a significant distinction between the "truth" which each discipline attempts to describe, probe at, or unveil, the strategies employed as "ways of knowing" each respective truth share a number of common traits.

II. Common Strategies to Explore Disparate Truths

In mathematics one of the most common and apt strategies to discovering truthⁱ is to employ the axiomatic system. Any axiomatic system begins with a collection of undefined terms; a set of things, states of being or concepts. These undefinables are things that we can all get a

sense of, but which are impossible to define because any attempt to do so results in circular reasoning or infinite regress. The undefined terms of neutral geometry, for example, are *point*, *line*, *incidence*, *between*, *congruence of segments* and *congruence of angles*. They are all terms we are familiar with and understand how to interpret and how to apply, but we cannot assign exact meaning to any of them.

Painting, too, has a collection of undefined terms. They include specific colors, color temperatures (i.e. warm and cool), values (i.e. light and dark) and edges (i.e. soft and hard). Any attempted definition of these concepts will inevitably require the use of the term in the definition, and is thus a futile endeavor. In his book on painting, Richard Schmid defines *value* as “the range of lightness and darkness within a subject,”ⁱⁱ but let us consider an attempt to define a *dark value*. We might say something like a *dark value* is something darker than a light value. Thus we must be able to define *light value*. For the sake of consistency we ought to define a *light value* as one lighter than a dark value. Thus the definition of *dark value* depends, in our example, on the definition of *light value*. From the infinite regress that occurs when we attempt to define *dark* and *light value*, we may infer that in this scenario, the terms are indefinable.

For an artist, trying to define a specific color results in the same sort of circular logic. *Red*, *orange*, *yellow*, *green*, *blue* and *violet* may be defined absolutely in scientific terms by wavelengths of light. However, the artist does not paint with light; she paints with pigment. If we want to know what *red* is in terms of a color of oil or acrylic paint, a proper definition might be the color that lay between *purple* and *orange* on the color wheel. So what, we must know, is *purple*? Our answer might be the color of pigment on the color wheel that lay to the left of *red*, or the color yielded when *red* pigment is mixed with *blue* pigment. So, like defining a specific value, we see that in defining a specific color we have to use the definition, rendering our attempts at assigning some sort of standard signification to these terms completely fruitless.

Just as the mathematician must work with points and betweenness though he can not define them, the painter works with color, value and edges every time she paints. They must be

constantly in mind every time she touches paint to her canvas. These terms are indefinable because they name components of painting that are relative. What looks dark depends on its surroundings to determine its degree of darkness; how dark we perceive an object to be depends not on the intrinsic value of the object, but on how dark or light the surrounding elements are. In Figure 1 we see two small rectangles of middle gray, one surrounded by black and the other by white. The rectangles are the same color, yet the one surrounded by white looks darker in value than the one surrounded by black because there is more contrast between the two values. Similarly, what we call *blue* depends entirely on what is taken to be *red* and what color we're calling *yellow*, as my beginning painting class painstakingly learned while we spent hours constructing a color wheel from scratch. To construct the wheel we had to keep in mind that the complement of each primary color (red, yellow and blue) is the mixture of the two other primary colors. For example blue is the complement to orange, which is the mixture of red and yellow. Likewise, the complement to any secondary color (purple, orange and green), is the primary color from which it is *not* mixed. Purple, the color yielded when mixing blue and red, has yellow as its complement, for example. In this same way, any color mixed from the primary and secondary colors, be it aquamarine or mustard yellow, has as its complement a mixture of the complements of each primary and secondary color used to mix the said color. When my class set out to create a color wheel, we began with this knowledge, but without having at our disposal a single color which we could name in absolute terms. Through the process of constructing the color wheel it became clear that each specific color is defined entirely in terms of other specific colors, and is therefore relative. No color may be absolutely defined for an artist dealing with pigments.

Just as axiomatic systems contain a set of axioms, or rules stating relationships between and interactions among the undefined terms, so too is there a "rule book" of sorts among the undefined terms in the vocabulary of the painter, more accurately, perhaps, called relative terms. Colors, temperatures, values and edges have a complexly joined, reciprocal relationship with one another. Each may be defined only in terms of the other. Moreover, each *determines* the others.

The relationships between the relative terms of painting are like the axioms of a mathematical system in that they provide a basis from which the rules of relationships and interactions among the undefined terms may be understood. In painting, these rules are simply assertions of optical phenomenon, what occurs in the entangled relationship between the pigment in the paint, the light cast on it and reflected off it, and the way our eyes interpret the stimulus. I'll give a few examples of the "axioms of painting" below, rather than trying to compile an exhaustive list.

If two distinct values meet at a hard edge, then the values appear higher in contrast to each other; if they meet at a soft edge the disparity between the values appears to lessen. Moreover, if two values have high contrast with one another, any edge at which they meet will appear hard, whereas if the values are more alike any edge between them will appear softer.

Other "axioms" of painting illustrate the relativity of color, and the reciprocal way in which colors can affect one another. Take two colors A and B. Mix the two in some proportion to achieve a third color, C, that appears to be "in the middle" of the other two. When compared with A, C will appear to have more of color B in it. When compared with B, C will appear to have more of color A in it. This is illustrated in Figure 2 with blue and fuchsia mixed to make purple.

Another "axiom" of painting could be entitled the Mutual Intensification of Neutralized Complements Axiom. It is as follows: When two neutralized complementary colorsⁱⁱⁱ are placed next to one another, they mutually intensify each other.^{iv} This can be seen in the Morandi painting in Figure 3. The neutral yellow looks more intense because it is adjacent to its complement, neutral purple. Conversely, the neutral purple, too, looks intense when paired with the neutralized yellow. It is as if the yellow area draws the traces of yellow out of the neutralized complement to make it appear more candidly purple, and vice versa.

It is logical to wonder, upon identifying the relative terms of painting, and the "axioms" that establish their relationships, what comes next? How do color, value, edges, mutual intensification of neutralized complementary colors, etc., all work together to create a painter's

truth? I'll argue in section three that for a painter, each painting has or describes a separate truth. With this in mind, I'd like to draw out one last comparison between an axiomatic system in mathematics and the system of constructing a painting, or a truth. In math an axiomatic system begins with undefined terms. It states the axioms to establish the rules of existence and relation among the terms. Then theorems, lemmas, corollaries and propositions are deduced and proved from the axioms. In the end there is a collection of definitions and statements which describe a mathematical truth such as hyperbolic geometry, Euclidean geometry, et al. The way of establishing the system or truth is very dependent on the steps taken to achieve the collection of statements, and the *order* in which those statements were established. For example, if Lemma A is required to prove Theorem B, Theorem B cannot hold until it is established that Lemma A holds; order is crucial.

Similarly, in the construction of a painting, order is crucial. The painter begins with his undefined terms: a palette full of paints of varying colors, temperatures and values, and brushes and knives with the ability to create edges of infinitely varying degrees of harshness and softness. Mentally, he has in mind the "axioms" of painting—the optical principles to which his pigments and brushstrokes and the eyes of his viewers will adhere. As the painter begins to place dabs of color on his canvas, she must place them in a strategically advantageous order. Just as Theorem B could not hold until Lemma A was proved, the painter cannot paint the iris of a figure's eye and the highlight on her cheekbone until he has blocked in the shape of her head and painted the underlying structure of her face.

It is through the compilation and exploitation of the technical tools explored in this section that the painter may give rise to the truth he wishes to express. Robert Henri argues for the importance of these technical tools when he says that painters must "seek technical excellence so that [they] may give compelling expression to [their] thoughts."^v Similarly, Schmid claims that "what sets the visual artist apart from the rest of humanity is his ability to give visual form to an idea—the skill to transform it into something more than merely insight or perception alone"^{vi}—

the skill to transform it into artistic truth. The next section is a discussion of what these truths are, and how the truth of art differs from the truth of mathematics.

III. The Nature of Artistic Truth. How it Differs from Mathematical Truth.

There are two fundamental differences between the truth that is established by mathematics and the truth established by most art in general, and paintings specifically. First, the truth of art may be created, while mathematical truth must be discovered.^{vii} Second, the truth of mathematics is absolute; it is a truth that may be known only through a stipulated and unchangeable collection of concepts, statements, and rules, none of which may contradict the others. The truth of art, however, is better referred to in the plural (i.e. “truths”), for they are infinite, negotiable, and one artistic truth may contradict another.

The goal of a painting is to make a statement in visual form. The statement made is the truth of the painting. A work may portray a situation or setting in an attempt to reflect a truth occurring somewhere besides the artist’s canvas, or the surface of the canvas—the work itself—may be the truth. Some artists wish for their work to be a mix of both—a reflection of some outer reality and an emphasis on the surface of the canvas as its own reality.

Picasso once said that “art is the lie that tells the truth.”^{viii} A painting is a plastic creation which, to a degree, is reflective of reality. It is a “lie” because it is plastic, but the message it sends reveals some bit of truth which the artist wishes to convey. In *Guernica*,^{ix} Picasso created a painting which displayed the gruesome bloodshed of the Spanish Civil War. He wanted to unveil to the world the truth of the injustice and the carnage of the war.

Some painters, including the Renaissance masters of 15th and 16th century Europe and the Photorealists of the 1980s, wanted the experience of looking at their canvases to be like looking through a window at the real, physical, waking world. The view, however, is contrived. The artist may add, remove, or alter elements as she or he pleases. This may be to finesse the

aesthetics of the composition, or the manipulations may be to add effect to the intended message of the work.

Modern artists of the early twentieth century realized this, and began creating art that was a direct response to and rebellion against realist painting. Magritte painted with the accuracy and precision of a realist, yet the truth he wished to espouse is that art is not real; it is a plastic creation. *The Pipe* is a painting in which he very accurately and convincingly rendered a pipe, yet at the bottom of the canvas Magritte has painted (in French) the words “this is not a pipe” in order to drive home the point that artistic reality, because it is a plastic representation of reality, is a separate entity from real reality.

Picasso created a series of collages whose purpose was to emphasize the idea that the surface of a work of art is its own reality. He realized that when we read, we are aware of the surface of the page, but when we look at a realist painting, we experience it as if we are looking through a window; the surface of the canvas is lost and the viewer is not consciously aware of it. In works like *Still Life with Chair Caning*,^x he puts letters, often randomly chosen ones, into the composition to bring the literal surface of the canvas to the attention of the viewer.

Surrealists, like Magritte, Dalí and de Chiraco, believed that our conscious, waking state is one facet of reality, and the unconscious dream world is another facet. Combined, they give us a more complete view of true reality. The best way to unite the two, the Surrealists thought, was through art. The landscapes that Dalí and de Chiraco painted were attempts to portray waking and dreaming realities simultaneously. Their landscapes would contain ground, sky, buildings, and figures just as we experience in our everyday, waking state of being. Yet they would add visual elements we could never see in this reality. One of de Chiraco’s favorite techniques was to paint shadows cast in the wrong direction. Dalí would morph a figure into a rock, or a clock into a pool of liquid and droplets. It was their hope that these paintings were surreal, or transcendent of the reality of the waking world and that of the dream world to describe true reality.

For Jackson Pollock and some of his contemporary Abstract Expressionist colleagues who worked in New York in the 1950s, the reality of a painting was more about the *process* than the end result. Pollock would drizzle paint from cans onto the large surfaces of his canvases. As he worked, the artist was almost entranced, and while in the end he had a painted canvas to show for his efforts, for Pollock painting was more like a performance piece than a visual art form.

The mathematician works to discover truth; the painter works to establish truth. The truth that the mathematician hopes to discover is a part of the same truth his colleagues work to unveil. However, what that truth may be varies from artist to artist, and even from work to work for a single artist. Sometimes there are multiple truths an artist would like to convey in a single painting. In art, unlike a mathematical system, contradictions in truth are entirely allowable. It cannot be true, for a mathematician, that P and $\sim P$ hold simultaneously. For an artist, however, it is perfectly possible to espouse two contradictory truths in a single painting, the result being the creation of a third, perhaps more profound, truth that serves as a commentary on the first two. Take, for example, Magritte's *Empire of Lights*^{xi} where it is simultaneously night and day, or as the mathematician might put it, it is simultaneously night and not night. For the mathematician, this cannot occur. For Magritte, it was truth.

ⁱ This assumes one believes, as I do and as most contemporary mathematicians do, that mathematical truths are discovered (Formalism) and not created (Logicism).

ⁱⁱ p. 80.

ⁱⁱⁱ To neutralize a color, it is mixed with a bit of its complement to "gray it down."

^{iv} An *intense color* may be defined as one that is not neutralized.

^v As quoted by Schmid, p. 189.

^{vi} Schmid, p. 191.

^{vii} Again, this assumes Formalism, not Logicism; see footnote I.

^{viii} According to my painting professor, Melissa Wienman-Jagosh.

^{ix} See Figure 4.

^x See Figure 5.

^{xi} See Figure 6.



Figure 1



Figure 2



Figure 3
Still Life, 1960. Morandi.



Figure 4 *Guernica. Picasso.*

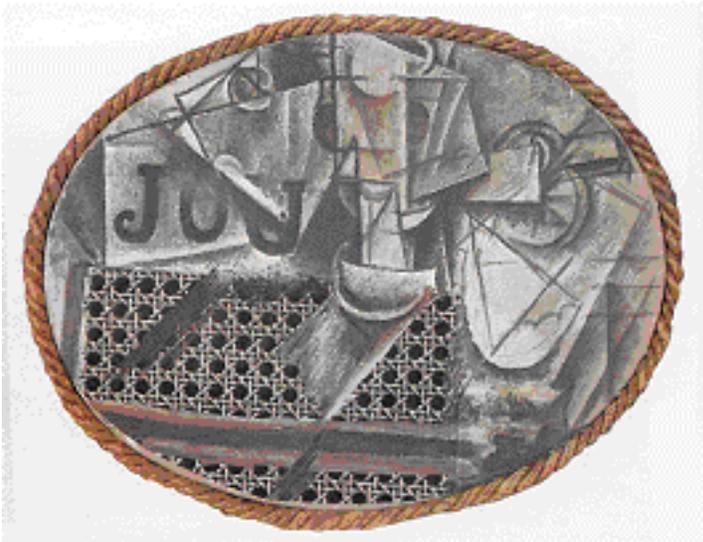


Figure 5 *Still Life with Chair Caning*. Picasso.

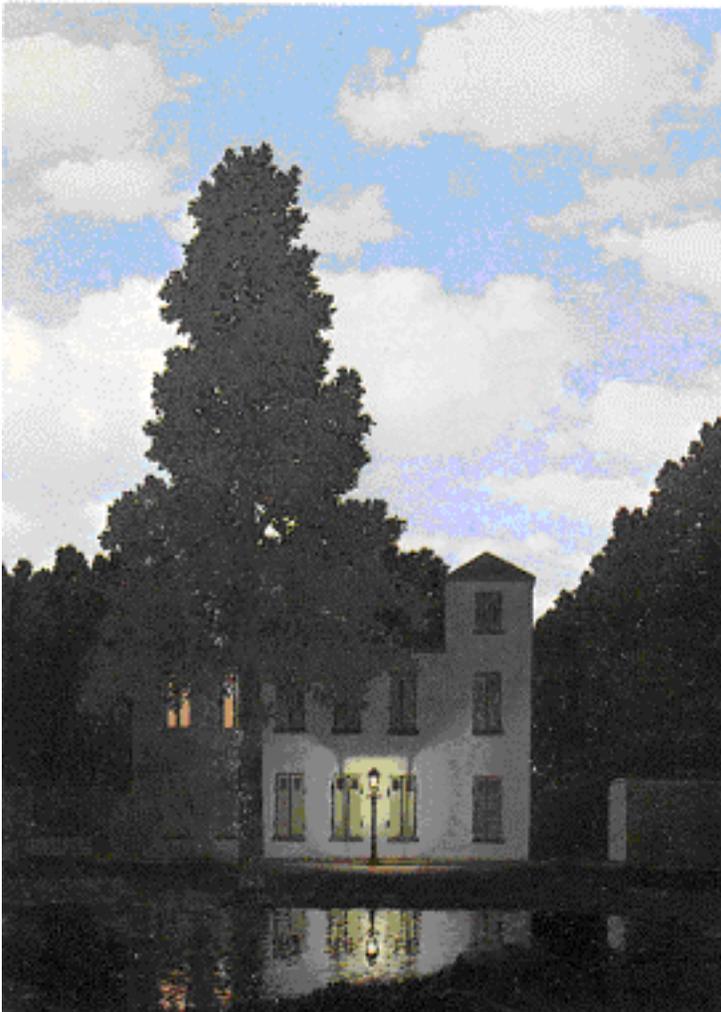


Figure 6 *Empire of Lights*. Magritte.

Sources Used

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Morandi, Giorgio. *Morandi*. New York: Rizzoli International Publications, Inc., 1988.

Schmid, Richard. *Alla Prima: Everything I Know About Painting*. Colorado: Stove Prairie Press, 1998.

Much of the information I gave in the paper was a collection of things I've learned in the past four years through hands-on work in five studio art classes, lectures in two art history classes, visits to galleries and museums in Europe and the United States, and readings from multiple textbooks on art and art history.