"Treat nature by the cylinder, the sphere, the cone" -- Paul Cezanne to a student.

The traditions of art education in European and American art schools are clear: use geometry to create art. But which geometry is most useful? Why aren’t we using the crenallated, mobile geometry of clouds in the summer sky or the dendritic branching of tree limbs and river’s tributaries as our favored models? Why do we rely on obviously abstract concepts like line and shape modeled as perfect square or circles, and then cylinders and spheres? Aren’t these geometrics invented human forms, not actual natural ones?

**Why This Set of Shapes and not Some Other Set?**

Cezanne’s words echo a very long lineage of considering how to draw and paint in the context of a regular geometry of symmetrical, predictable forms built from shapes like rectangles, triangles, and circles extended and combined into three dimension to produce cylinders, spheres, cones, eggs, pyramids, cubes, and many polyhedra. Why do art teachers teach shape concepts right away, and which shape concepts ought the artist start with in order to gain an improved ability to see and interpret form? Cezanne doesn’t really answer why. He just says to go do it. So do many other artists and art teachers. I’m not satisfied to merely believe them, however, similar ideas do occur in Asian cultures of art-making. For example, Edo period Zen artist Gibon Sengai:

Sengai did not title his painting, but it if often referred to as "The Universe" in art history texts, illustrating the Zen notions that the circle can represent the infinite, which is then subdivided into more recognizable forms such as the triangle, which when doubled becomes the square or rectangle. The progression continues where the triangle and square are viewed as possible basic units of growth, leading to the wide diversity of all other forms in the universe. The abstraction of the circle, triangle and square is seen as a representation of real things that exist. I wonder if Sengai knew of Galileo's famous considerations:

Philosophy is written in this grand book, the universe, which stands continually open to our gaze, but the book cannot be understood unless one first learns to comprehend the language and read the letters in which it is composed. It is written in the language of mathematics, and its characters are triangles, circles, and other geometric figures without which it is humanly impossible to understand a single word of it; without these, one wanders about in a dark labyrinth.¹

Abstract painter Vasily Kandinsky was similarly interested in the universal aspects of geometry, and he attempted to develop a set of abstract patterns that relied on basic universal shapes.

Vasily Kandinsky, Composition 8 (Komposition 8), July 1923. Oil on canvas, 140 x 201 cm. Solomon R. Guggenheim Museum, New Yorkii

So too did later 20th Century artists like Mondrian and Sol Lewitt rely on highly linear, regular geometry to create their abstract artworks. Cezanne's advice, however, unlike Gibon's, Kandinsky's and Mondrian's and most of Lewitt's artworks, is not two-dimensional but is a rounded three-dimensional cue: the sphere not just the circle, the cylinder not just the rectangle, etc. Many artists have grown the components of art into three-dimensional solids, to build sophisticated mental models of things like the human figure so that you can draw people from the imagination, as Michelangelo did, as Leonardo did, as Albrecht Durer did. One of his most famous engravings, Melancholia, is filled with representations and references to his love of and hard work with shape, geometry and its mathematics:
Although the historical and cultural precedents for Cézanne's directive are clear, it is for me somehow very dissatisfying, however, when artists simply say you should use basic geometric forms to help you draw or paint in their traditions. And sure, if you practice the transferable and specific skills that the teachers propose using curricula they designed over hundreds of years of refinements, you do gain increased visual acuity. But what if you'd like to try some other art style? And just exactly why did they choose that geometry of flatness and angles rather than some other kind of non-Euclidean geometry?

Wasn't the use of Euclidean and Pythagorean geometries just a matter of popularity and what students had been taught? Why aren't our basic ideas of shape more like trees and less like bricks? Why in art do we use straight lines when, if you observe nature closely, you see that there are no straight lines. In Nature there's a lot of wiggly shapes, funny crenellations, odd bendiness and unpredictably chaotic liquid flow. Where's the straight lines? There are edges, surely, but are they roughened or are they really straight? Sometimes I think that the only straight lines are ones that people built, like telephone poles, which truth be told are often slightly conic and tippy and bending under the weight of power lines that droop thanks to gravity. The summary straightness we describe the horizon with, for example the distant edge of Lake Michigan kissing the sky, is actually wobbly and a little bent in places -- we abstract it to a straight line, although it actually is much more complex.
Often straightness is a bit of an illusion, or a kind of perceptual shortcut. Another example: I live in an old Victorian house that at first glance appears to be made of rectangles and squares and plumbed edges, but if you measure it with a level you'll find there's not one level, straight surface anywhere. Instead the entire house is a lot of bendy, angled surfaces that make it hard for tables not to sit without wobbling on the uneven flooring. The architectural Ames illusion reveals the same problem, with greater drama, in a room that appears to be full of straight horizontal and vertical edges but which is actually made of tippy trapezoids. When viewed from the correct angle, the illusion makes it appear that two equal-sized people are extra tall and extra short:

The Ames room illusion overwhelms our expectations regarding size and scale, expectations neatly described as size constancy. According to neurologist V.S. Ramachandran, one explanation for why we misperceive space in the Ames room is that the mind generally selects for the most common explanations, using built-in assumptions and patterns, which in some cases lead us to the wrong conclusions about what we see.\(^\text{iii}\) The illusion can be powerfully used for movie and photo special effects: according to a variety of websites, the Ames room design was used in stage sets for Peter Jackson's *Lord of the Rings* trilogy to make hobbits appear short when compared to Gandalf\(^\text{iv}\). Sometimes what appears to be straight lines in fact are distorted angles, imbalances, and exaggerations. This goes back to the basic question – aren’t we dynamic creatures in dynamic spaces, full of goofy
forms and changes, not predictable Platonic solids made from idealized eternal forms. So it's strange that art teachers want us to have minds full of straight edges and c-curves and the resulting predictable shapes which are used to build up the less predictable shapes. In visual art, why don't we just start with organic wackiness instead of predictable symmetries?

Actually we do start with organic wackiness, in three ways. First, in fact the human eye is bouncing all over the place all the time, in series of rapid saccades that we barely notice. And much of the time you're seeing, you are also blinking and closing your eyes and not seeing -- also which you barely notice. On a daily basis, eyes are constantly adapting, moving, focusing, opening/closing, and shifting around with great speed. Secondly, inside the brain very specific kinds of cells and their configuration lead us to recognize many kinds of shapes, and some kinds much more easily than other kinds, and, these configurations are tracked with contrast-seeking cells and cells that react only to direction or line. Thirdly, perhaps tracking the eye and mind movement and matching with their clumsy hands, infants who start drawing always start with scribbling (what could be wackier?) and then gradually proceed to develop more and more geometric patterns. Children who can barely speak nonetheless when given a crayon and paper will move through a strong and reliable series of shape formations as they learn – there is a process of shape-making that is fairly reliable across cultures.

Researcher Rhoda Kellogg studied how children draw across many different cultures, and found that children move slowly from scribbles to circles, crosses, boxes, quadrants, grids, stick figures, and so on. Every child follows the same basic graphic evolution, just as every child learns to speak in her culture's languages. And just as the spoken word aims at communication, the drawings that children make are meant to tell a story. Often they reveal intense amounts of knowledge of the world, such as that houses have roofs, that cars have steering wheels and pedals, that people have eyes and skin color and hair color and attitudes. For the most part we all go through these phases. [see Kellog, The Art of Children] In other words, perhaps our idea of shape, and how we teach it stems more from relying on the processes we're already using than from mere constructs to be deconstructed. This is a basic scientific observation that has not been attended to in postmodern literary and art theory: shape arises out of common, shared human experiences and biology -- thus culture has adapted its practices to our humanity, our nature. We also adapt to culture. There's a feedback cycle, such that we must say not that we are products of either nurture or nature, but rather, that we are 100% nurture and 100% nature. Art is Nature and Nature is Art. An example of this is writing.

**Write What You Know, and Teach From What They Already Know**

If you're reading this text then you are interpreting my thoughts, mind to mind, precisely, and probably I don't even know you. That's a very odd thing, and it reveals how incredibly useful the design of written words is: we can communicate by time travel, disconnected. You're wherever you are, and I'm right here in North Adams in 2010 typing this manuscript. How do we do this? Visually. Reading and writing involves the most frequent use of our visual perception on a daily basis -- seeing how very tiny strokes of shape can form into recognizable words of entire languages. In fact literacy is a fairly new invention. So far as we know, writing was invented only a few thousand years ago.

Human beings have been around much longer than that, meaning that we did not evolve to write. Spoken language we certainly have had for much longer, and, many animals like us also communicate via sound. Some, like the Bower bird, construct ornate nests that seem to contain symbols -- shiny and colorful objects that female Bower birds seem to be attracted to, if they are arranged just so. And we
know humans constructed vast monuments, buildings, earthworks, and sculptures. But trying to interpret today just exactly what an ancient Native American tribe meant by building a mound in the shape of a bear’s outline, like the beautiful Bear Mound near where I grew up in Wisconsin, or what the moai statues of Easter Island actually mean is tricky. Visual perception researcher Mark Changizi put it this way when discussing how different writing is from other visual forms: "If your goal is to have your message actually understood, this tactic (of making statues) is worse than writing abstruse poetry, and literally much heavier. The only thing we're sure of from such communications is that those prehistoric people had too much free time on their hands." However labor intensive and long-lasting they are, we just don't know what these statues mean, not in any literal sense. Visual art is often similar, and most museums today include explanatory written notes on the walls next to the paintings, to help viewers quickly learn what the painting means.

Like bear mounds and giant head sculptures, many paintings have no clear meaning. The Mona Lisa, for example -- she is smirking a little, but why? Is it that she's considering a naughty limerick? Was Leonardo merely using psychology to engage the viewer? Could she have just eaten a good snack? We just don't know. Neuroscientist Margaret Livingstone wrote a delightful neurological explanation regarding why the Mona Lisa appears to be smirking more from some viewing angles than from others, detailing how her smile fluctuates depending on whether you are using directed vision or peripheral vision when sensing her mouth. This explains why we sense a smile, but not why the person is smiling -- we have no idea what this character might be thinking. A lot of contemporary artwork is intentionally vague, so that we can have multiple possible interpretations of the art's content. And yet for all that we are easily convinced when looking at a painting we are looking at the sitter, that this is what Mona Lisa looked like -- or at least what Leonardo looked like dressed in drag. Photos are similar: a picture of your parents is really showing you your parents, or so we quickly conclude. It does look a lot like them even if like in the Mona Lisa we don't know what they were thinking.

In contrast, the written word has very specific meanings that get at our thoughts. We can know nearly exactly what someone means, if they write it -- and surely you are exercising this very skill right now while you read this book. Stephen King in his book *On Writing* said that writing is like telepathy, a very precise meeting of minds across untold distances of time and space. It could even be a distant dead author speaking to you. And yet there are no tiny letters scattered throughout the landscape. Letters and words just don't appear in nature; we make them, we benefit from them immensely, but they are synthesized human products not naturally-occurring patterns found in stone, right? Changizi asks of reading and writing, just as I've asked of regular shapes, "why are we so good at such an unnatural act?" [p. 165 *The Vision Revolution*, Benbella Books 2010] There’s another similar question, which is "what natural visual abilities do we have that helped us go from seeing shapes to making shapes, designing them to our own uses?" All of that relates back to recognizing the history of art's use of symmetrical shapes rather than wacky organic shapes: why? To get at good responses to these questions, we must not only consider our eyes, but also consider the environments in which vision evolved.

Recognizing how contemporary culture is radically different, more technological, and filled with concepts and words than what would've been possible fifty, a hundred, or twenty thousand years ago, a colleague of mine once asked me to imagine what it would be like to travel back in time and teach a college drawing course to cavemen. How would you explain drawing to someone who's never seen a drawing, who you can't even talk with? And would they believe that drawing's valuable enough to study, practice, and improve? Where would you begin? What would be the first lessons that you'd have to teach to someone who's never seen a drawing before? My glib response: I would sell them car insurance, like the popular ad series on television featuring insurance that's so easy even a caveman can...
do it. More seriously, I don't think it would be all that difficult to grab a little charcoal from an old fire and start drawing on a wall, demonstrating rather than verbalizing.

And actually more fun than me demonstrating all alone would be to give a group of cavemen some charcoal and all together start scribbling until like children learning to draw each individual developed common graphic symbols and procedures, from which we could then build far more complex drawings. I think we might make some portraits of Ug and his wife Snurrga because they are fat and easy to draw with scribble-circles and Ug's beard sort of looks like a giant scribble which we all discover we can make even if we have no artistic training. Scribbling is like the movie caveman's grunt: we might not know what we're saying but we're saying something. The fact is that we could just by getting together and scribbling gradually develop a quite refined series of basic marks like lines and c-curves, these are almost always easy results of the directions that knuckles, wrists, elbows and shoulders can move in anyway. It's not like we can draw a picture of an expanding supernova in one go. Our limbs don't move that way. Think of it, line equals reaching for something, curve equals reaching around something. Who doesn't need those two movements to survive in the wild?

Noting the core passions required for such movements, the artists and exceptional draftsman Rico Lebrun once wrote: "lines should be drawn as if they are sandbags in a flood." [check this quote, Drawing.] But I think that for children lines are more likely drawn with urgency because they are playful creatures in the mind, circus tents, memories, stories, natural extensions of our muscularity and bones. Yet the urgency must needs be present, or else why bother? And perhaps to aid that urgency, like children drawing stick figures I would introduce to prehistoric peoples the drawing of images of people (Ug and Snurrga), the human form which we are all curious about, and maybe in the nature-leading way suggested by Lebrun:

Close the books of other people's stuff now and dig with your eyes. From things. The ultimate goal is to be neither distorted nor concocted nor expression-mugging nor calligraphic nor synthetic nor exhibitionist nor resourceful but helplessly natural; considering who we are and where we came from no one has yet done a true natural house of man. Bodies, unsolicited and unscrutinized, still hunger to know what they are.

In other words, if you're going to teach cavemen then start where they're starting, proceed as nature proceeds, and build up from they can do and already know. Skilled teachers know, of course, that you can't just expect students to know everything in an instant. You have to begin where they are, help them build steps towards what you're teaching, and basically just get into the fray with them, and all go out on a limb together. Knowledge of course, is social and dynamic and linked deeply throughout culture -- a tool as simple as a crayon embodies thousands of years of innovation and creative thinking.

**WWCD? (What Would Caveman Do?)**

Would prehistoric people, given a crayon, develop shapes in the way that children today do? It's a good bet that they would. Pencils might seems like magic to a caveman, not to mention paper, or the drawing app on an iPhone. To teach art to a caveman you might have to forego a lot of knowledge, language and technology that we take for granted. To teach outside of our artifactual, technological culture, you'd also have to find ways to persuade of the value of the artistic practice -- a value that isn't obvious compared to the value of a bow and arrow, a good solid spear, or a warm fire to weather through a cold night and grill mammoth steaks and tubers for dinner. We can only guess what range of
experience early humans might have had, but judging by their skulls and the fossil records, we can conclude that they were very likely as smart and creative as we are.

A variety of anthropologists and other scholars have noted that the funerary practices of ancient peoples were highly complex. For example, the records show that many cultures included ornate decorations in the grave, that the deceased were decorated, often with items such as hand-carved beads [see *Homo Aestheticus*, by Ellen Dissanayake]. And from this we can conclude that ancient peoples had the time and the motivation to do things like create thousands of beads. Craft, decoration, technique, technical ability -- all of these were important to ancient cultures. It may well be that if you could travel back in time you'd find ancient cultures were rich with all sorts of artifacts and artifice. These facts point to the idea that ancient peoples were sophisticated, and that so-called primitives weren't really primitive in any biological or intellectual sense.

Basic human biology is the same as it was a hundred thousand years ago, and the same across cultures (in point of fact we are all 99.9% genetically similar to each other, we're practically clones despite what seems to be the huge differences in our appearances) (space aliens might well think we all look alike). Just like figure drawing of people, we aim for biology and environment, not an art that exists for art's sake (because, after all, the cavemen don't know what fine art is -- there's no museums full of pictures sitting in the middle of the wilderness, charging too-high admission fees and employing maintainers and preparators and curators and cafeteria workers and building a 'creative economy'). We must step back from all of that and go back to basics, our human nature. So if you take advantage of that biological basis, it should then be possible for you to learn to think what a caveman might think, and for a cavemen to learn to think what you have been thinking -- with careful study, experimentation, and so on -- across the barriers of time. Hopefully someday in the far future an enterprising artist will be able to read this book and compare its contents and the evidence of my thoughts against new knowledge regarding the human mind of the future. And hopefully this book will be easier to understand and parse for meaning than the Mona Lisa or the maoi of Easter Island, since after all I'm trying to say some very specific things that will help you understand how to compose more and better pictures.

**If All Else Fails, Physics Can Help: Why You Can’t Not Make a Shape**

Like our shared human nature, there are more unavoidables when creating visual art, in terms of the physics of mark-making. At the same time as learning to understand the natural progression of graphic shapes and forms that people learn as they draw, if you were in the future, or as I suggested in the distant past, to grab a piece of charcoal and start drawing on a wall, you'd automatically end up making a mark on the wall. And every mark, being physical, no matter how small or how large, produces a shape. Every mark results in an undeniable dimension. It could be an informal dot-like shape, or perhaps a very thin tall rectangle (a line), or maybe a blob-like smudge or wacky smeary. But in all cases regardless of how you make the mark, it will have some depth and some height and some width, however big or small those directions would be. Shape is unavoidable. Shape is basic. And as soon as you start combining these initial shape-marks with each other, you cannot avoid arriving at other bigger shapes. Big shapes are automatically made of little shapes which result from the unavoidable fact that even the most casual mark is some sort of dimension, some dimensional sub-shape. We just can't help it. No mark is without dimension, and no big shape is made without combining a few smaller marks.
One wonders which shapes occur throughout nature, and how do we tell one object from another? That basis comes together through a handful of different lines of thought: Center/Surround cells of visual perception; groupings of concepts of objects that we gain through our wiring and our experience; plus what kinds of visual cues we rely on during the process of differentiating one object from another; how these relate to the marks we can make, supernormal stimuli and why they work, and the scientific understanding of symmetry as a primary process of our visual perception.

Viva la Difference: Center/Surround Cells and Contrast-Seeking

First, how is it that we can differentiate one object from another, visually? By touch, of course you can reach out and feel how an object has a form, edges, and so on. But visually we look for contrasting patterns of light and dark, especially abrupt changes in luminance. Our eyes are contrast-seeking organs. The mind’s visual processing center’s rely primarily on a configuration of cells called Center/Surround cells.

First discovered in 1953 by Stephen Kuffler, and subsequently studied by numerous researchers, center/surround cells are fundamental to human vision. Here’s what they do: they don't respond to gradual changes in luminance or to how much light is present, but they do encode where there are changes and discontinuities in luminance.

So for example, imagine a room filled with one big spotlight that illuminates all the walls of the room evenly. Everything is similarly bright. Center/Surround cells don't care about this situation, they don't respond. But, if you focus the spotlight into one small beam on one wall, or break it with some filters into a thousand pinpoints of light like a planetarium projector does to show the patterns of stars at night, then your Center/Surround cells are highly active because they respond to all the differences in points of light next to regions of darkness. Center/Surround cells encode difference, not similarity.

In her book Vision and Art: the Biology of Seeing, Margaret Livingstone notes how the most information in a visual scene is in the transitions, the differences and discontinuities, not in the self-similar sections. Thus coding for the differences saves precious brain-power. Among the very first visual processes of our eyes are retinal ganglion cells responding to light, and these are all arranged in center/surround configurations, communicating to more groups of neurons deeper in the brain, such as in the thalamus which also have the center/surround configurations. In other words, all of the sudden shifts in patterns of light and dark become our knowledge of where one object ends and another begins. The process can be very fine, such as your ability to read a single letter in this sentence and tell it apart from other letters, grammatical symbols, or the stars in the night sky. It is by finding differences that we see edges, from which we gain the understanding of objects (if a group of abrupt luminous-change locations, edges, stay together while we or they are moving, then there’s an object.)

For this reason, contrast is a fundamental aspect of the visual arts, the making of pictures. The old joke is that while looking at a white canvas you might be seeing a white cow in a field of white snow -- what, don't you know that there's a cow there? Can't you see it? Of course not, not anymore than you can see a raven in a dark closet where there is no light. Without contrast, there is no visual art, no images. The renaissance artist Ghiberti was known for saying 'Without light there is no art,' a phrase today known as 'Ghiberti's Maxim.' This idea persisted for generations, reflected in French Academic painter and teacher Nicolas Poussin’s notations that “Nothing is visible without light. Nothing is visible without a transparent medium. Nothing is visible without boundaries, nothing is visible without color. Nothing is visible
without distance. Nothing is visible without instrument.” In terms of our contemporary understanding of vision, it would be a lot more precise, however, to say 'Without abrupt changes in luminance there are no images that we can see.' In the 20th Century, Kasimir Malevich's Suprematist composition *White on White* put the lie to the idea that visual art has to include obvious contrasts, since his painting was only two very subtly different tones of white, unlike the single white tone of the canvas discussed in Yasmina Reza's later Broadway hit, *Art*. The fact remains, to see anything, we really do need luminance changes thanks to the prevalence of Center/Surround cells in our visual brains.

All of these big and small contrast changes become our sense of where objects are in space, and what are their edges. Consider for example this famous 'figure-ground' illustration:

This is an astonishing picture – and once you see it’s content there’s no going back. Isn’t it amazing that you can see a Dalmatian so easily despite that there’s no outlines at all, just very carefully distilled and placed dark spots and light regions? You can also make out leaves and a tree trunk. In visual art training the sense that there's a clear and consistent edge, although the artist never drew one, is called implied line. Our ability to form groups of shapes together into recognizable objects is furthermore called the gestalt, or more simply, grouping. And messing up the groupings and implied lines yields camouflage, leading towards design ideas such as the mimicry and exaggerations of caricature. Luminance contrast and the functions of our Center/Surround cells make it possible for us to make distinctions. Building up from Center/Surround cells, which cause us to differentiate and group bits of light and dark, we also do the reverse and put these bits back together to create groupings of contrasts, to understand edges and ultimately objects. Arnheim (1956) and Gombrich (1973) both suggested that such groupings were essential to the earliest stages of visual processing, and since their time a great deal of neurological and visual studies have been done confirming that our visual perception doesn’t just pull contrasts apart, but
it binds them together too. In their study of the neurology of aesthetics, Ramachandran and Hirstein suggest that the key function of binding results from the need to save resources using feedback loops:

Given the limited attentional resources in the brain and the limited neural space for competing representations, at every stage in processing there is generate a ‘Look here, there is a clue to something potentially object-like’ signal that produces limbic activation and draws your attention to that region (or feature), thereby facilitating the processing of those regions at earlier stages. Furthermore, partial ‘solutions’ or conjectures to perceptual problems are fed back from every level in the hierarchy to every earlier module to impose a small bias in processing and the final percept emerges from such a progressive ‘bootstrapping.’

That brains interact with and steer perception is well-known, including the odd fact that often you perceive certain types of moving objects a tenth of a second as they are in the future rather than in the exact location of an object in the present. Being able to make good predictions certainly is useful if you’re running through a field trying to avoid obstacles. Indeed some types of predictions are a lot more likely to be true than others, which leads to another fact of vision: the Generic Viewpoint Principle.

Another well-studied basic process that helps us recognize shapes (and thus objects) is what Artificial Intelligence innovators call the Generic Viewpoint Principle. It states that minds prefer to select patterns that can explain a lot of viewpoints rather than patterns that can only explain one viewpoint. The viewpoint that explains the most common configurations of contrasts and shapes is seen as much more likely than the viewpoint that explains only one situation. For an example of this, consider this simple diagram about looking at a stop sign with a street sign that appears to be behind it:
We tend to assume that the image on the upper left represents an overlay of one street sign with another. The most likely explanation is #1, showing the scene from a slightly different angle where you can make out both the stop sign and the street sign. The Generic Viewpoint Principle specifies that this is the visual conclusion that we tend to make because it is based on all the other sign configurations we’re likely to see and it is also the most likely possibility. Far less likely is #2, that the stop sign is complete but the other is a cutaway. We also don’t normally expect a gremlin to be hanging from the street sign hidden by the stop sign, nor do we suspect that actually both signs are one large piece of metal, with one leg bent away so you are fooled by perspective, and with a snake symbol on the back. We assume the more common and more likely interpretations of what we see. This effect is so strong that many magic tricks rely on using incomplete backdrops to hide props and models from view, creating surprise and entertainment in the process.

When I was a child I used to try to imagine what it would be like to walk through a forest and come upon a tree, only to walk around it and see the side of it that was hidden from view while approaching was in fact not a tree, but perhaps a robot or stage prop. If you saw it from the front, it looked like a tree. But once you saw it from the side or the rear, you learned it was something else entirely. Probably I got this idea from how numerous science fiction stories play on our expectations, for example that what looks just like a muscled Arnold Schwarzenegger on the outside is actually an even more terrifying Terminator robot on the inside. Normally when you see a deer in the forest you don’t think that if you walk around and view it from the reverse angle you’ll see it’s full of robot parts.

![Generic Robot Principle: Front View vs. Back View, G. Scheckler 2001, digital photo collage](image)

According to the Generic Viewpoint Principle, we don’t expect the most unusual appearances. Our visual perceptions, and thus many of our conceptions, select for generic viewpoints rather than highly unlikely, unusual ones. What then are the most common patterns in nature that are likely to fall within the Generic Viewpoint principle? If you think about implied lines, such as in the Dalmation diagram, you see that our ability to group contrasting shapes together yields our sense of edges (or vice versa that luminance contrasts create edges that yield our sense of implied lines). Changizi refers to the predictable patterns that are formed along edges as 'Natural Subthings', meaning the kinds and types of intersections we find when we identify the edges of objects: common visual formations in nature that
serve as a basis for the form of how we design images such as the letters in an alphabet. These formations are groups of little lines.

**Identifying Subthings in Nature: From Environment to Photos to Letters to Drawings.**

To illustrate Changizi’s subthings, here is a photograph I made of Warren Falls, in Vermont. It’s quite a bit more complex in terms of luminance contrasts than the Dalmation figure/ground diagram, and in it one can identify many objects and their edges:

![Warren Falls photograph](image)

You can quickly and easily see that there's water, snow, rocks, and trees. Relying on your Center/Surround cells you find the major and minor contrast differences and your mind identifies edges -- you know where the water stops and where a rock begins. You form an idea of objects this way, linking together edges into identifiable things, binding and grouping using the Generic Viewpoint Principle, or in arts parlance, the Gestalt Principle. I suspect that you are not thinking that just below the surface of the water the Lady of the Lake is holding Excalibur, waiting to mistake you for a modern King Arthur. More likely, you are thinking that the water looks cold and that therefore swimming here could be quite dangerous. These distinctions between one region and another in the photograph are sort of like outlining, which I’ve overlaid and then isolated in the next picture, just to emphasize the formations that these outlines tend to create -- remember, we’re talking about visual cells and networks that filter for contrast change to help you find edges:
I marked the edges of some big prominent objects: a boulder, the cliff side, a tree trunk, a ramp moving upwards, the edge between water versus stone, etc. If you were to float across the river on a nice warm canoe, you’d need to identify any obstacles in order to climb safely up the ramp without falling into the icy water and then dying of exposure to cold. One slip or misstep could add up to lots of misery. This is the core of the idea that we’ve evolved in relationship to our environment, to survive by locating objects large and small, some to be avoided, some to be travelled, and of course some to be acted upon as food or reproduction.

As for how we see, it's the luminance shifts that are used to reveal the locations of the edges that tell us where relevant objects are that matter the most. And these edges intersect with each other in predictable ways. You'll notice that the intersections often make an L, T or Y or X-like shape. My diagram above shows many L, T and Y intersections, outlined. If you look at overlapping branches or their shadows, you can find a lot of X shapes. These are the ‘Subthings of Nature’: the small visual cues that help us determine what are the things, the objects that we need to know about. Everywhere two objects intersect, there is a subthing, the beginning of our understanding of how to separate one object from another.
In a series of studies of the typical kinds of edges and intersections found in nature, Changizi and his students have developed a comprehensive set of 19 common configurations of intersections, well beyond the easy-to-find L, T, Y, or X-like intersections in my photo. Additionally, we need to take into account how visual perception arrives at line-like shapes. According to neurobiologist Semir Zeki’s famous book, *Inner Vision: an Exploration of Art and the Brain* [Oxford, 1999], in addition to Center/Surround cells, many brain cells are also directionally selective, for example they only fire when horizontal or vertical movement is experienced, and some only when movement is from right to left, others only in other directions. How our eyes typically saccade and bounce around and locate these movements, and how our brains respond to directional movements such as the flow of water that was present when in the landscape as I made this photo, is hard-wired.

Although Center/Surround cells seem like they would produce fine pixels just as a photograph is made up of an evenly spaced set of millions of tiny dots, another group of studies showed that the brain’s workings are quite different and much more dynamic. According to foundational researches in the 1950s by David Hubel and Torsten Wiesel, cells in the visual cortex respond mainly to straight lines and angles of light, not to dots of light. Hubel and Wiesel discovered that the neurons act on contrast rather than on brightness, and on straight lines rather than dots or curves. The combined effect of contrasts and lines not only explains how some abstract paintings can be visually pleasing, but also explains a mechanism for how we sense edges and thus recognizable objects. For their discoveries, Hubel and Torsten were awarded the Nobel Prize. It doesn’t seem far from their studies to suggest looking for common patterns among all the little line-like intersections that we can see in nature, Changizi’s Subthings.

From his large set of 19 subthings, something clever can be seen. First of all, it’s easy to find things like L-shaped and X-shaped intersections in nature, but it’s hard to find "fist shapes" or "chair shapes." Compound intersections are much more rare than simple ones. And the simple ones look a lot like what our written language looks like. This is good reason to suspect that letters are shaped as they are is
because they are like most of nature, we designed them to be like obvious patterns that we see frequently and are good at seeing, not like extremely rare patterns. Perhaps in design written language we’ve done what we can to make literacy as easy as possible. Indeed in subsequent studies, it’s been found that writing has very close to the same frequency of the most common subthing shapes as nature does. And this is as true of Chinese writing as it is of English. Changizi summarizes that "In general, the more common configurations in nature are also the more common ones in human visual signs." (p.197-198, *The Vision Revolution*) This is a ground-breaking idea – usually written language is treated as a verbal activity, not a visual one. But when it’s treated visually, we see it has a very close correspondence to natural forms.

I suspect the same is true of methods for making artworks, that artists just like calligraphers and font designers rely on the most common patterns seen in nature to make compelling images that we can interpret: why not take advantage of the visual processes that we’re good at, if our goal is to communicate aesthetic meanings?

Take another look at the Bargue plates and the first stage of the intended drawing, made of simple straight lines and c-curves, measured carefully and then trimmed down into smaller forms. Remember also how after passing through the scribbling stage, the way children draw exhibits rudimentary shapes. A child’s stick-figure of a cat is quite pictographic: simple straight lines and curves formed together as symbols of meaningful objects. A drawing of the cat reveals a lot about what is known about a cat (it has four legs, pointy ears, a tail and big whiskers), but the drawing doesn’t look like a cat -- it’s pictographic, a little picture-word, not imagistic. It is made mainly from visual subthings, and written language is quite similar: each letter is composed of a few strokes, highly rarefied to represent a sound or utterance. In fact the average number of strokes per letter in most written languages is three, which is enough to create complex forms, like triangles (or cat ears), but simple enough to draw fairly quickly. [see Changizi, p. 187, for a chart of 93 written languages comparing average numbers of strokes across cultures: 3.]

Yet the image-based systems for academic painting and drawing differ from writing-- the same basic procedure of little straight lines and small c-curves and how they intersect and interact is used, and is the basis of the process, but what one uses them for is different: instead of the creation of compound letters or childlike pictograms, with realist art we’re aiming for compound light and shadow shapes which can then be articulated into more and more complex forms. Letters and drawings may begin in the same ways, but they can result in radically different outcomes.
In the Bargue method, the artist arrives at various subthings via careful visual measuring, as a result of visual work (and not necessarily a goal of making subthings unto themselves). That’s similar to the process our brains go through from initial visual input through the eye and then center/surround cells as groupings of perceived lines and edges to build shapes. And that’s not all that different from all the subthing intersections you can find in a much more casual children’s drawing:

[by G. Scheckler, 1974, age 6]
Another line of thought here is the considerable amount of research that has been done regarding ‘form constants’ that have been derived from patterns seen in hallucinations, synaesthesia, or just pressing on your eyes too much. These are often described as spirals, circles, waves, grids and lines. For example, in one of his articles artist and educator Michael Betancourt provides this diagram as a taxonomy of common form-constants:

Betancourt’s taxonomy of form-constants is very similar to entoptical patterns known as phosphenes, which occur during mild hallucinations and other visual anomalies. While complex hallucinations are full of cultural imagery, more basic simple visual effects like phosphene and form-constant patterns are universal, that is, experienced across many cultures. Probably the first scientific discussion of these kinds of patterns was in the early 19th Century, by Johannes Purkinje, followed by studies by Heinrich Kluever, and by Max Knoll. Numerous researchers, including child’s art researcher Rhoda Kellogg, have commented on the similarity of forms used by children in their drawings compared to the forms found in adult’s phosphene experiences. Astronauts have reported similar visual effects as a result of adjusting to low-gravity environments. In other words, we know of distinct physiological links that cause us to sense and employ rudimentary geometric patterns. They are common patterns in abstract art, Paleolithic or ‘cave’ art, and visual experience. They are artefacts of how our eyes and brains function. And we now also know that many of these same kinds of patterns, as intersecting subthings, occur repeatedly throughout nature, which indicates why we evolved to sense such patterns.

The universality of these patterns is an affront to postmodern art theories that falsely assumed that the arts are entirely synthetic, built out of equally interchangeable constructs that only exist for political or semiotic reasons. To the contrary, numerous geometric formations occur as a result of nature and our biology’s response to the environment, which is shared universally across human cultures. This allows us to link many kinds of visual activities. Putting the Subthings together to form letters of a written
language is analogous to putting Subthings together to create the basis of any image. Groupings of lines and intersections create the sense perception of objects, which we can see in part because of basic mechanisms and filters of our center/surround cells and other characteristics of visual perception. As I mentioned before, the artist's mark automatically creates dimension, and putting marks together makes bigger dimensions -- compound shapes, and thus more and more ability to articulate form. And furthermore, some systems of visual perception filter for precise directions of lines and the locating of edges, as well as movement. In this sense we cannot help but see shapes. The calligrapher and the child artist and the cave painter and the realist painter are all taking advantage of these neural processes and natural occurrences, in a kind of reverse of what happens during visual perception.

Making Art is Perception in Reverse: from Life-Form to Form-Life

One of my friends has a dog named Piper who loves to romp and play and be brushed because she has thick fur. And Piper is especially fond of chasing hawks. She is so eager to notice them flying overhead that merely pointing at the sky will get her to look up and see if there's a hawk. And if there is, she'll bark and start chasing it, keeping an eye on where she's running all while moving after the direction of the hawk. She doesn't chase crows, or cardinals or doves, or barn swallows. Just hawks. The speed with which this occurs is astonishing -- usually Piper notices hawks long before anyone else. If you see a hawk before she does, and you say her name and then look up at the sky, so too will Piper look, then bark, then chase.

Piper noticing a hawk, Oct. 2008, by G. Scheckler

Piper's process is the opposite of what happens while making a painting. Piper perceives the world, filters and selects and points her attention within microseconds, and then acts on her perceptions while
predicting the track of the hawk. In contrast, first the artist develops the idea to make the painting, built out of whatever visual experiences and imaginations and memories are necessary. Then the first things painted to make a realistic image of the bird are rough outlines and big generalizations, slowly refined, to arrive at sophisticated images -- the artist starts with the generalities of things like line, shape and contrast, whereas visual perception arrives out of light's signals and towards generalities later. In contrast to Piper’s speedy attraction to hawks, it may take hours or even weeks for the painter to develop a beautiful painting of a hawk in flight. In the middle of the process is the same range of generalities -- a crucial link between visual perception and visual art, although the process of the one's filtering is the reverse of the other's beginnings. It could be that the filtering processes of visual perception create large-scale generalities quickly, that I may have some of this process misstated, but the fact remains that the visual content, all the light that you see, is there first, whereas the artists starts with little content and builds it later. The eminent 20th-Century artist and teacher Bernard Chaet had a sort of formula for understanding this idea, how the artist's role sits in the middle of a series of feedback cycles. He wrote:

Forms from our imagination or from the physical environment, which we call life forms – such as tree in nature or demons in the mind of Bosch – are transmitted by the artist’s vision and skill to create something new – a form life. This cycle from life form to form life begins in drawing when the artist, haunted by an image or an idea, puts his pencil to paper.\footnote{11}

In other words the artist's creativity sits somewhere in the middle of rich perceptions and rich abstractions... a room hung with pictures is a room hung with thoughts, and in the past, the artist engineered those picture-thoughts. Author William Faulkner noted a similar idea, “The aim of every artist is to arrest motion, which is life, by artificial means and hold it fixed so that a hundred years later, when a stranger looks at it, it moves again since it is life.”

But how does this translation from one time to another actually happen? We can suspect that the formation of written language and its efficiencies, and the graphic basis for realist art training, such as the Bargue-Gerome system which reflects generations of similar pattern books, stem from what things really look like \textit{at the same time as} being developed as basic conventions of visual perception and how our hands and arms can move: the building of systems of symbols from what it is that our vision does and how bodies and how our environment works. The symbols work because they were designed to take advantage of how our perceptions function, what we’re already good at seeing. Changizi’s description of such events hinges on understanding the environments out of which our visual perception grew, the forces of natural selection on how we see and consequently, on the art we create. Changizi summarized his ideas: "Natural selection made the eye good at processing objects in nature, and so culture evolved visual signs that had properties akin to those of objects of nature, so that the eye could process them as optimally as possible."

By now you've put together what we know from some of the neurology of vision and perception -- how we are sensitive mainly to abrupt contrast changes, which we use to identify subthings, shapes, and objects -- to see that artists old claim to rely on basic shapes is not merely a habit of Plato's and Aristotle's reflections on early geometry, not just a matter of taste, nor merely a wayward construct to be deconstructed. It is also part and parcel of how we see and how we are able to think. (And dogs are pretty good at it too!) And, we've linked the visual content of verbal written language with the visual content of pictures with how children draw and how adults can draw even when the outcomes -- how each of these visual activities creates meaning -- is radically different in both aesthetics and superficial appearances. Scientific analyses of how vision works has provided us with the links we need to
understand visual culture as a whole as a product of biology, environment, and design regardless of differences in visual style, thus providing us with verifiable workarounds for the ancient problems of subjective tastes. We haven't described why we have different tastes, but we have found a great deal of objective content and explanatory theory that we can use reliably to measure and test our claims about images in ways that don't require mere subjectivities. The story is also more complicated than this, because we're very good at certain types of shape recognition, and typically bad at other shapes.

Symmetry-Seeking: Good at Some Shapes, Bad at Others

There's another catch in the mechanisms of how we process contrasts and edges to conceive of shapes, and that's symmetry. Just as our eyes and many neurons are contrast-seeking organs, our minds also rely on symmetry-seeking procedures. In addition to being good at noticing and using luminance contrasts, from which we build many mental models which in turn feedback into how we see, we are also much more able to recognize certain kinds of symmetrical shapes than unusually asymmetric shapes.

Indeed symmetry has long been considered in the visual arts to be beautiful, in fact Alberti in his Renaissance treatises lists *symmetria* as one of the foundational aspects of the graphical beauty he found in proportions, numbers, and their positioning. Much more recently, Irving Biederman and graduate students Xiaomin Yue and Jules Davidoff recently published a study in *Psychological Science* (2009) that described how people are good at identifying and remembering 'nonaccidental versus metric' properties of shapes and forms.

The study involved testing both western college students who have a lot of exposure to geometric shapes, as well as the Himba of Africa, who have very little exposure to common geometric shapes. Unlike most college students, most Himba do not have access to computers, the Internet, cell phones, and the books and toys of Western life. Comparing how the Himba perceive shape with how college students do should therefore provide some clarifications regarding what is and is not a learned ability. If college students are remarkably better at regular shapes than the Himba, then we could suspect that culture plays a large role in shape perception and identification. Similarly, if the Himba are better at these tasks, then maybe they know something that we don’t. And if neither group is better, then perhaps we have clear evidence that shape perception is hard-wired rather than acquired from culture.

A non-accidental form is one that stays the same as you rotate it, for example, a sphere or a cube, whereas a metric form is one that changes shape as you rotate it, perhaps because one side is curved or uneven. Biederman’s team found that both groups (western students and Himba) were equally sensitive to non-accidental properties. And since both groups do this equally well, we can conclude that we don't have to give our children those stupid plastic toys that are supposed to train shape recognition and build your I.Q. by having you put little star-shaped blocks into star-shaped holes -- the Himba don't have these toys and manage to do just as well as westerners do when it comes to recognizing non-accidental symmetries. Genetics, our visual processing, and our environments already provide what we need to be able to recognize symmetrical forms quickly and efficiently.

This kind of study adds fuel to Cezanne's insistence that when drawing one benefits from starting from the sphere, cylinder, and cone. Cezanne was repeating well-known art education mantras, but today we can see that shape isn't just an art educational device, but is a universal way of thinking. These are the
kinds of non-accidental, symmetrical forms that we’re all good at processing, so we may as well take advantage and rely on them when building pictures in reverse vision. Like face recognition, we now can know that many kinds of visual perception are hard-wired in that we can recognize contrast, shape, and symmetry distinctions regardless of cultural upbringing or background.

This is not an entirely obvious set of conclusions and there are some noteworthy exceptions. Early studies by anthropologist Colin Turnbull (whose river boat trip was memorialized in the Bogart and Hepburn film *The African Queen*) described how some African tribes of pygmies didn’t have a strong sense of depth perception. Turnbull suspected they did not because, living deep in the forest surrounded by closely packed foliage, the BaMbuti rarely saw open skies, plains, or other kinds of long distances. Turnbull described the experience of one of the BaMbuti, Kenge. When Kenge was brought to an opening in the forest to look across a distant field, he mistook a distant herd of buffalo for a group of small, but nearby, insects. As they group drove closer and closer to the buffalo, Kenge became unsettled. According to Turnbull "what puzzled him still was why they had been so small, and whether they really had been small and had suddenly grown larger, or whether it had been some kind of trickery."

Turnbull’s often-quoted study is sometimes used to defend the notion in the arts that visual perspective, and indeed depth perception itself is largely cultural determined and is not a product of how we see, not biological in origin. Such arguments conveniently leave out the possibility that Kenge was merely mistaken, or was one of the ten percent or so of people who have some form of color blindness or other common visual anomalies, or whether Kenge perhaps needed corrective glasses. Maybe due to nearsightedness he just couldn’t focus on faraway buffalo and so they seemed like fuzzy gnats hanging in the air? Many studies since Turnbull’s reports have been far better and more rigorously controlled, which demonstrate that visual processing is essentially the same for most people. Still, Turnbull’s description should serve as a good warning. We have a lot to learn about vision and culture and how they interact. We must keep in mind that some of vision and perception and thought is built in, but many aspects of it might not be, might be learned. It certainly has been my own experience in the art classroom that beginning students haven’t built the visual concepts that a realist painter uses to see, and then represent, the world with great acuity.

I also wonder why it would be an evolutionary advantage to recognize non-accidental shapes so automatically? Is it that foods like vegetables and fruits tend to be symmetrical, and rounded? Is it that the human face is mainly symmetrical? It is the same with the appearances of many animals -- ones we might eat and ones that could be threats to us? Are the crenellated, chaotic forms of a summer sky’s cumulus clouds or the broken crystalline shapes of mountains neutral to us in terms of our survival, however beautiful they may at times be? And if so, what does that mean for landscape painting or photography? We can establish that there are kinds and types of shapes that we humans easily and automatically recognize, and kinds that we do not. Clouds are highly random, metric forms in contrast to regular shapes such as an apple or other food source.

So if you ever have to teach a clan of prehistoric people how to draw, start with something that all of our brains are already good at: the ability to recognize non-accidental shapes that stay the same as they rotate in space. This fundamental ability to find and sense symmetrical forms hints also at a larger capacity of human vision, namely principles for how and why we sense symmetry, which in turn relates to the arrangement of shapes as recognizable patterns -- the basis of composing visual art. This doesn’t really answer how we’d convince prehistoric people that any of this effort is worthwhile. Why would they respond to an artwork? What’s the use?
Shape and the Supernormal

Outside my college office I’ve placed a beat-up old bronze copy of the famous Charioteer of Delphi. Here it is as photographed under night conditions and then daylight:

Late at night, after the janitor has shut down most of the lights, the Charioteer has an uncanny way of looming in the dark. One of my colleagues, a psychology professor, kept telling me how he’d walk by and experience a big double-take, catching the sculpture in the corner of the eye and mistaking his own movement (walking down the hall), for a real live person standing in the corner. Much to my surprise, even though I know it’s a sculpture and I put it there, on rare occasions I too have in the dark done a big double-take, startled by the Charioteer. The same thing happened just the other day when I found the discarded casing of a young cicada, a beautifully dried shell in an intricate beige tone, but of a very mean-looking bug. I took the casing in my hand to carry it home only to realize that although I knew it wasn’t alive, whenever the air shook it a little in my hand it felt exactly like a live bug. I was so startled I dropped it. Picked it up again. And then ten steps down the trail got startled all over again – it’s amazing how scary a sculpture or shell of an insect can be, despite how much you know about them. These factors experience hint at another fundamental property of vision related to shape and form: a kind of psychological impact that certain kinds of shapes have, that suggest we each think and perceive by relying on distinctive models that we match with and even expect to see. When these models are exaggerated, we react to them much more vigorously than when they’re normal. When exaggerated greatly, they’re called supernormal stimuli.

The term was invented by the biologist Nikolaas Tinbergen, who in his studies learned a great deal of oddities, such that a bird would tend to prefer to sit on a large, fake egg painted with bright polka dots rather than sit on a real, smaller egg that had a subtler dappled pattern. Exaggerated dot patterns produced greater stimulus. Similarly, male stickleback fish attack fake wooden models if the model is
painted more red than a living competitor. Young blackbirds shown two discs, one about 1/3 smaller than the other, react exactly as if they are seeing their parents approach a nest; chickens and ducks react to simple arrangements of crosses flying overhead as if they are goose or hawks, depending on which direction the cross is moving; and male butterflies will attempt to mate with fake cardboard butterflies so long as the fake’s patterns are more pronounced than a real female. Brains, as it turns out, are very expensive to run. Thus the more ways that an animal has to save effort and time, the better. And one way is to hard-wire visual shortcuts. Why does something so artificial as shapes on a stick waving in the air fool young birds – or, why does a sculpture of The Charioteer of Delphi in the dark surprise a psychology professor? The author Simon Ings, in *A Natural History of Seeing*, (Norton 2007) concludes that

> The world is not full of flying crosses or carefully proportioned black discs but it *is* stuffed with parents, siblings, predators, mates, and prey. To recognize these things from every possible angle, under every possible light, animals make generalized models. Our experiments fool them only because we’ve presented them with a model that closely resembles their mental model.

It’s a lot better to be fooled by shapes on a stick than to mistakenly think that the prototypical shapes you are seeing aren’t a threat or a necessary piece to your survival. It’s much better to be mistaken a little bit of the time if the process also allows us to be correct most of the time. We make assumptions and many simplifications about the world as we see, and many of those basic biological assumptions are just a simple shape, a typical natural pattern of contrast, or a typical proportion. So when we reduce the compound, wiggly horizontal pattern of the edge of the ocean meeting the sky into a simple straight line, we are adapting visual content to our basic biology, amplifying certain types of mental models.

In other words, if you can fool a baby blackbird with two little black discs into thinking its parents are approaching, then you can stimulate and even surprise a human mind with a sculpture. Or a painting. Or a movie. Or a book about how to compose pictures.

**The Perception and Recognition of Shape in Summary**

The suite of abilities that is our visual perception determines what are the most important shapes and objects for us to attend to in our environments by being contrast-seeking, symmetry-seeking, and pattern-seeking processes full of feedback loops and shortcuts.

We are good at decoding complex compositions made of millions of tiny shapes. Reading one book involves discriminating among millions of tiny shapes, letters that become words. Looking at words is not different than looking at pebbles on a beach, trees in a forest, or snowflakes in the palm of your hand during a beautiful winter storm, or paintings or photographs or famous sculptures. The basic procedures for drawing a letter, and interpreting its shape, are very much the same as the basic procedures for drawing an object and interpreting its shape, built up from the same classes of subthings, cell organizations, and conceptual shortcuts that we find throughout nature and throughout our ability to see. The processes for written language, general visual appraisals of the environment, and making drawings or painting are the same because of the biological necessities of the reader, the art audience, and the author-artist finding the most efficient ways to communicate given the natural visual abilities we already have and the brains that we possess. This is our nature.
We no longer need to merely insist on the basis of art traditions, as Cezanne did, that we artists ought to start with the cylinder, sphere, or cone. Instead we must today recognize that visual art, and the idea of shape in particular, is much more than an artistic convention, but is also biology and nature.

This recognition is a direct contradiction of postmodern deconstructivist thinking. For example, in his influential text *Of Grammatology*, in discussing his often-quoted phrase ‘there is nothing outside the text,’ Jacques Derrida argued and attempted to demonstrate that:

“... there has never been anything but writing; there have never been anything but supplements, substitutive significations which could only come forth in a chain of differential references, the ‘real’ supervening, and being added only while taking on meaning from a trace and from an invocation of the supplement, etc. And thus to infinity, for we have read, in the text, that the absolute present, Nature, that which words like ‘real mother’ name, have already escaped, have never existed; that what opens meanings and language is writing as the disappearance of natural presence.”

Unfortunately for Derrida, as influential as his theorizing was for the arts in the mid- to late 20th Century, he did not proffer evidence other than his own philosophical insistence that nature disappeared once language took offer. To the contrary, contemporary studies of visual perception, written language, drawing, and neurology combined do show us that our biology is inextricably interlinked with our environments. The very design of our written languages most likely stems from our experience of nature, and is best considered part of the natural not separate from it. The conventions of art and language strategies exist because they’ve been adapted from nature; to some extent we simply cannot help but use shapes. Subthings, Supernormal Stimuli, the ease of finding Symmetrical, non-accidental shapes, with reversals for art and language designed out of perception, and the long history of regular shapes as the basis of art education, all together point to the large-scale processes that are relevant to visual arts composition. And these grow out of far tinier, adept neurons that filter what we see in Center/Surround patterns for contrast differences, for directionality and movement, and then for combinations that form basic conceptual groupings like edges, gestalts, mental models and other basic contents of consciousness that help us recognize subjects and objects in our world.

What then, would a Martian Ethologist think about human artworks, if she came to Earth for a visit? Would a space alien, whose perceptions and biology are notably different than our own, who may have grown up in an environment rich with visual patterns that stem from a totally different geometry than ours, be able to use our art to communicate with us?

---

see also Guggenheim show: The Geometry of Kandinsky and Malevich, curated by Tracey Bashkoff and Megan Fontanella.

Ramachandran discusses this concept in numerous texts. But you can see it with a video demonstration of an Ames Room on YouTube at http://www.youtube.com/watch?v=Ttd0YjXF0no This is a clip from the documentary The Computer That Ate Hollywood.


see Livingstone, Art and Vision.

Rico Lebrun, in a letter in 1959, In the Meridian of the Heart

Poussin in a letter to Chambray, 1665, in Art in Theory: 1648-1815, ed. by Harrison, Wood and Gaiger (Blackwell, 2000). The editors point out that Poussin’s ideas listed here are reflections of commonly accepted 17th Century optics based on medieval works by Vitello and Alhazen.


see Chaet, The Art of Drawing

