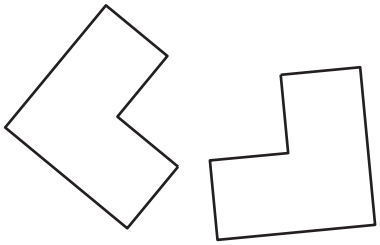
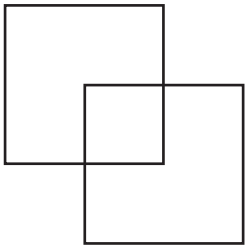
PREFACE

This book consists of one longish essay, “Shape Grammars – Seven Questions and their Short Answers,” and three supporting exhibits that are each self-contained yet invariably drawn into one another and into my seven answers – “Theory,” “Observations,” and “Pedagogy.” In my questions and answers, I make the case for visual calculating in shape grammars, and art and design, as a single enterprise in which everything aligns coequally. In art, there’s the complete sweep of visual things, and in design, a steady reminder of making and material, and function and use. The agreed approach to calculating, and art and design is to run the former through the latter, so that art and design conform fully to what calculating allows in terms of given axioms and prior invariants. The claim today is that calculating in computers includes everything we see and do, according to custom and plan. In fact, computers “take away the looking” to open art and design to art experts and the rest of us, in a comprehensive framework. (This is how the Rijksmuseum explains the use of computers in its current imaging and restoration of *The Night Watch*. The popular title of Rembrandt’s picture may be amiss in a new way. As soon as computers “take away the looking,” there’s nothing to watch nor anything to see – night or day.) The hoo-ha around this is incredible – that the extent of known to new is within the reach of data and machine learning, that there are “training sets” to define it, and that nothing else is needed. Time will tell how far this vast ambition goes without slowing down. My approach in shape grammars, however, is just the opposite – seeing informs calculating in art and design, so that calculating overtakes computers and what they hold, whether in logic or with data and learning. This is the only way I know to make calculating, and art and design coincide. There are many strands to this that bring in strange and wonderful things. These strands may seem very different, maybe irreconcilable – seeing that they’re really not and how they overlap and interlace points to my key aims and goals. It will soon be apparent that I find scant to recommend in proven disciplines – even sporting different hats on different days, a physicist now and a painter tomorrow. Nor am I drawn to interdisciplinary work that serves to reinforce separate methods and results in a combinatorial scheme, where everyone is an expert in his/her own area with no incentive to erase known boundaries, so that new configurations emerge and re-form freely in a total, esemplastic whole. This draws in diverse fields of interest to put them together in a single synthesis (sketch) that’s inherently ambiguous – for re-division and ongoing

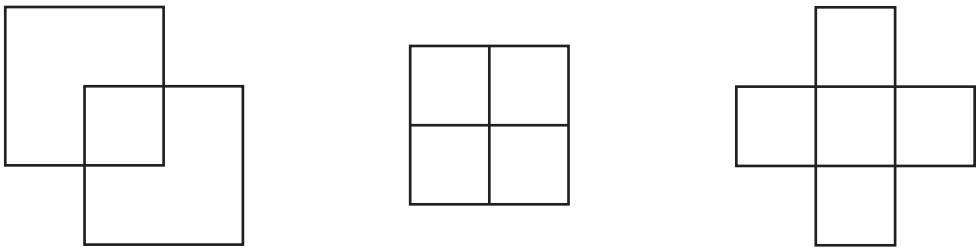
description outside of familiar taxonomies (trees, topologies, and graphs, etc.) that rely on fixed differences to map underlying relationships. (The kind of relationship that strikes me most is conspicuous in metaphor and figuration, and runs throughout drawing and painting, and visual expression in general. More than a hundred years ago, the analytic philosopher G. E. Moore described it rather neatly, in a tentative account of something else – “organic” relations for living/purposeful things, that elude “mechanical” relations like the combinatorial ones favored in logic and indispensable for computers and taxonomies. Somehow, reuse produces a positive result, as it dodges the egregious charge of plagiarism. Moore’s description begs to be tried on its own, to skew its original drift and purpose, and to steer past its known provenance. Each relationship of the kind I have in mind “alters the things it relates, so that it is not they, but some other [number of] things which are related.” Maybe this is an example of itself that shows what it means, as Moore’s intentions evolve into my meaning to change the one into the other. Or maybe it’s Oscar Wilde, who extends meaning beyond intentions in his aesthetic formula for pictures and poems, etc. – to see things as in themselves they really are not. This is limitless for most things, and especially in pictures; simple shapes are enough, drawing them with merely a handful of straight lines – surprises burst into view, too numerous to overlook and too fascinating to ignore. A pair of polygonal L’s



in another relation

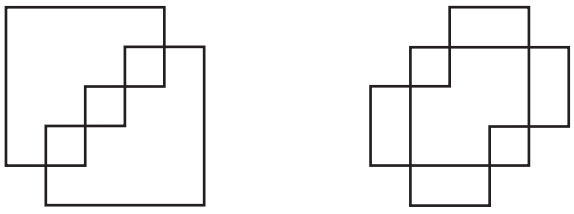


is two squares or three, or the center square in a symmetrical octagon with twin concavities, staggered on the left and right. There's plenty of anxiety not knowing what's next, and plenty of pleasure and delight, too, when I try to find out – I'm keen on sliding the L's into one another on their common diagonal to see what kinds of shapes I'm able to get. I can fix the L's and move them back and forth on this axis, so that the √2-distance x between their inflected vertices varies without any breaks, to describe new relations parametrically. It's the same with separate puzzle pieces or better, overlaying transparent tiles. When the two L's interact at -1, 0, and 1, they look like this



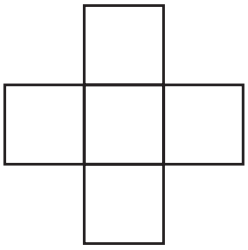
x = -1 x = 0 x = 1

It helps to fill in the gaps on both sides of 0, to see how different things can be. Try intercalating at -1/2 and 1/2 – the L's are independent/discrete with non-overlapping edges, in the way it is everywhere except at 0, even as their edges intersect copiously in distinct arrays, four times on a virtual straight line, and six times on the sides of a large square. The L's are quickly resolved when I use my finger to trace these intersections in sequence – they just pop out of what may seem confusing

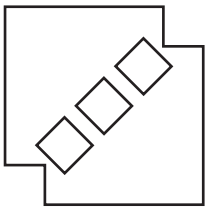


x = -1/2 x = 1/2

Four additional places complete my nine-fold survey, at 3/2 and 2, and anywhere less than -1 or greater than 2. Of course, L's aren't everything – if I let them change freely, in the way I did to start, other things unfold in the wanton sweep of my eye. It's amazing all there is to see in unrestricted play that's casually censored/lost, as parametric definitions fix things/parts for good in descriptions/representations that allow for position, angle, size, and other properties like color and material to vary. The agile eye isn't limited in this way; it steadfastly seeks for more – in this relation



both L's switch back and forth from one diagonal to another, or am I actually looking at four squares or five, or the center square in a Greek cross, or varied rectangles and T's, etc.? And how would I recast my parametric definition with L's – and when – if I wanted to rotate the three little squares at -1/2? There aren't any L's in the shape



The instability in all of this highlights the ambiguity that's everywhere in shapes. It's uncanny when definite things go together in one way, only to change into different things arranged in another way. The magic is hard to predict – I'm free to see, in an open-ended process in which nothing prior is given or known. This is a strong start on what shape grammars do when they're used for visual calculating, to bring in the vast ambiguity at the quick of art and design. There's no telling what my kind of relationship as in itself it really is. Logical coherence and scientific rigor, however, are paramount – so there's little concern that this might swerve wildly

out of control. The inconstant eye with its unsettled results is easy to pooh-pooh for proper relations in computers that are defined for constant/fixed/invariant things. These days, visual expression, etc. are ignored in computers, including object-oriented systems and machine learning, and when things stay the same as they merge in sets and lists, and other data structures. This welcomes parametric definitions and equally, John von Neumann's "visual analogies" and my "spatial relations" – in "Seven Questions," the three entwine to show why computers as they're commonly used aren't shape grammars. Surely, it's more productive to be a scientist than an artist, or at least to try and be coherent and rigorous most of the time – some hats are useless in pursuit of relationships that hew to proven norms in logic and science.) I'm happy to go from math and logic to painting and poetry in the same breath, in a single sentence and thought – the gaps dividing fields fade away leaving barely a trace. It presumes far too much to ask you to understand how any of this works in everyday practice, before I've posed my seven questions and you've had a chance to read my seven answers, where everything changes into something new as it combines. Isn't that the real point of a preface, as an advertisement to join an adventure – to get you to go on reading? Shape grammars are my way of showing how it works to calculate visually, in broad detail with a kind of algorithmic certainty. Shape grammars do the trick without giving up any of the ambiguity inherent in whatever you and I see, in a fleeting glance or that's patiently observed – no matter how slight the loss only for the time being, to make calculating practicable in computers. The promise of computers is a tempting lure in art and design for guaranteed results and mesmerizing effects, dazzling in novel displays, even as visual calculating in shape grammars embraces ambiguity fully. Evidently, shape grammars are entirely unique in this regard – that's the reason they make a real difference.

A few years ago, a journalist at a flashy design magazine wanted to do a piece on shape grammars, and asked me if I would help him out, with written answers to the seven questions in my essay. I agreed, but nothing seemed to result from the effort – I never saw my original, very short answers, or anything like them in print. The seven questions, however, stuck – they seemed to be a neat way to highlight some of what I'd been thinking about since the publication of my previous book, *Shape: Talking about Seeing and Doing* (Cambridge, MA: The MIT Press, 2006). I haven't altered the questions in any way whatsoever, or the order in which they were posed, although my answers have grown luxuriantly. In writing them out, I've tried to make

everything into an organic whole. No doubt, my enthusiasm for S. T. Coleridge is complete in unfolding one of my major themes – that shape grammars "in the *mode* of [their] operation" assimilate "imagination" and "fancy" in exactly the way Coleridge intended them. (To the Romantics, imagination was both feeling and poetry.) In order to merge this theme and sundry other ones, so that they're coadunate, I've used paragraphs sparingly, with long and short parentheses spread haphazardly throughout. Everything blends naturally, for the artist and critic in close proximity and the logician and artist at opposite poles. The sweep is vast and extravagant, and at times, crazy – for example, going from fancy to imagination in Coleridge demonstrates the need for "negative capability" in John Keats, and why "fact & reason" will never tame ambiguity and uncertainty in art and design. (Keats has it that Coleridge lacks a full measure of negative capability, "being incapable of remaining content with half-knowledge … with a great poet the sense of Beauty … obliterates [every other] consideration." This may be so, and maybe for Keats himself with respect to Coleridge. It's hard to give up on definite answers, and in fact, "modern judgment, it seems, can accept either Keats or Coleridge – not both.") In the same vein, Wilde's critical (Greek/aesthetic) spirit and the many charms of beautiful form, in varied modes of reverie and mood, mark the path von Neumann charts to probe the limits of calculating in pictures and the Rorschach test. (Differences stick, notably when there are data and computers to inform judgment; they make firm choices possible. Neither imagination nor negative capability is desirable, and as luck would have it, this isn't a problem – neither encourages computer implementation. I guess modern judgment is right to keep Keats and Coleridge apart – to do otherwise would take shape grammars, to foster imagination and revel in its vibrant ambiguity.) Diverse ideas, and themes of all sorts commingle mutually and grow as one, without explicit individuation and segmentation – that's left for reading in the way shapes have parts that are left for seeing. And as this process evolves, things rarely stay the same. There's no overarching outline, underlying structure, or hierarchy to arrange and order what I say; it's mostly talking freely about what I see, and that this alters smoothly as I go on. Moreover, there are some adventurous footnotes that tie-up, even in straightforward enumeration. This may be the place to start, to see how outwardly separate ideas fit together when it comes to shape grammars. I've tried the rhetorical methods I use in my essay on a wide range of readers – those familiar with shape grammars and not, and those at different points in between these extremes – and they seem to work effectively for almost everyone. Each of the following three exhibits has its own pattern of growth, too. In the first exhibit, I do some nice math for shapes and shape grammars – I've always

felt a strong moral obligation for this, if only to prove that visual calculating in shape grammars works as rigorously as any other kind of calculating that's been defined in precise, formal detail. Shapes aren't numbers or symbols, but this doesn't mean that calculating with shapes isn't calculating just the same – and it isn't necessary to describe/represent shapes in numbers and symbols for this to work. It's odd that anyone would think anything else – seeing is hard to argue with – yet somehow, seeing the math seems to be what makes the case irrefutable to everyone. (It's astounding how quickly the pieces fall into place in a key analogy implicit in "Seven Questions." The analogy is a productive template for other analogies – lots of them. It compares Coleridge's ratio that distinguishes imagination and fancy, and my ratio for shapes and symbols. These pairs correspond like so –

imagination : fancy :: shapes : symbols

– I highlight new pairs in my analogy twice outside of this parentheses, although scores dot my preface. Of course, not all pairs work; some are similarities – for sure, artist and critic, Keats and Coleridge, and von Neumann and Wilde. Neatly, shape grammars capture the reciprocal relationship in every pair that aligns with shapes and symbols – maybe artist and logician – in terms of the dimension i, where i is 0 for points and next, 1 for lines, 2 for planes, 3 for solids, etc. Then, $i \geq 0$ for shapes, but often, $i \neq 0$ to draw sharper distinctions, and $i = 0$ for symbols. This is easy to illustrate in the ordinarily dubious ratio of 1 to 0, that is to say, for lines and points.) In the second exhibit, I show why seeing and shapes are invariably unstable, and why the inherent ambiguity makes such a huge difference in shape grammars. My presentation relies first and foremost on line drawings, and how they change in funny ways, as I try varied parts, transformations, and boundaries in a recursive process – by repeated looking and re-drawing. In truth, looking tends to be enough. The asymmetry is unavoidable – the eye is the highest judge in visual calculating. And finally in the third exhibit, I put everything together to show how the first two exhibits add up for teaching in art and design, not in a typical combinatoric/set-theoretic (mechanical) sum in which things remain independent, each with an invariant identity, but in a visual (organic) sum in which things disappear as they meld and alter. My trio of exhibits traces another route to traverse my seven questions, among surprisingly many alternate ways that seem worth taking, elucidating and equally scenic. It strikes me that all roads meander pleasurably through green fields in a lush and overgrown landscape to a common destination – yes, shape grammars. And why not? Shape grammars are an inclusive way of calculating that takes in how the mind thinks in terms of descriptions and

representations, and amazingly, the myriad myriads of extravagant things the eye sees that elude prior analysis – or simply borrowing from Keats, what imagination holds for artist and poet to “see, where Learning hath no light.” (There’s little doubt that learning has greater reach today than 200 years ago, especially with statistics, data, and computers, but serious omissions persist – descriptions and representations are incomplete in computers and not, and this isn’t something evanescent or ready to fix.) No one seems to care very much about the kind of seeing I have in mind, and what it does in visual calculating. Seeing is taken mainly for granted, despite the fact that there’s nowhere for genuine thinking to go without it. The conditions required I order for seeing to kick in seem forever beyond knowing; there’s really no clear path to approach the magic (aesthetic/creative) that, that happens automatically before thinking takes off and whenever it spins and turns to indulge a sudden intuition, that promises a new purpose and fresh goals. Seeing works freely in shape grammars because it supersedes thinking, in accord with my analogy tying imagination and fancy to shapes and symbols. And this extends to the rote results of learning and the constancies in computer/mechanical relations, and to analysis, data, description, representation, and the vast number of things that come with some kind of fixed/unalterable structure – tellingly, visual analogies and spatial relations. The proof plays out line by line in my seven questions and their short answers, and with no detail left out, in *Shape*.

I take seeing and calculating seriously to show how the one (seeing) expands the other, so that together they include art and design – and to show why seeing is necessary in calculating for it to add anything of value and aesthetic import to creative activity. I’m often asked why I bother to tie in such different things – they’re fine apart, the way they’re meant to be. Isn’t the mathematics of shape grammars enough? It’s largely unfinished with plenty to do – surely, you should continue with that. The math alone merits your full attention and effort – why worry about art and design? My answer is twofold. First, I’ve done a lot of math already, and try to encourage others to carry on, in this remarkably enjoyable pursuit. And there’s a growing number who can, well versed in unsolved problems, and ready to allow in what seeing in art and design implies to find effective solutions. Second, and of greater importance, shape grammars from the start have been part and parcel of a full-fledged aesthetic enterprise in open-ended visual perception, and other modes of sense experience. This relationship is something to affirm overtly once and for all, here via Coleridge, and also in league with von Neumann and Wilde, among many others inclined in similar ways. Then, everyone in art and design can take

a deep breath and finally relax, join in and not worry about the math – and that art and design are at root calculating. The math is just another way of talking that helps explain in marvelous detail what you and I see and do. It isn't only numbers and measuring, and flashy pictures for messy data, difficult equations, and impossible Julia sets. Pictures may work in science but invariably, this is a recipe for bad art, betrayed in Wilde's aesthetic formula that discourages fixed intentions. Useful things are ordered, classified and sorted uniquely by use – defined, described, represented, or simply named. And useless things reverse this; they're what they really aren't in untold ways – after all, "All art is quite useless." The idea is to link visual calculating in shape grammars, and art and design reciprocally, so that nothing can take away the looking – whether use or any other prior description. Useless things are infused with life once seeing (perception) is added to calculating; it's "poetry in motion" as they alter – this to that to this, etc. This raises another question about computers and aesthetics. Recently, there's been a rash of studies (mostly in PhD dissertations) on the history of computers and what they do in/for art and design, in particular, in architectural practice and landscape design. These all end pretty much in the same way – even if they have their uses, computers fail to reach the visual core of art and design, and in fact, don't try, bypassing it altogether for objective and scientific truths that are entirely independent of us, and indispensable for professional standards to hold across the board. Still, the intuitive/subjective (aesthetic) impulse at the quick of art and design is undiminished and remains at full-strength for the fickle yet focused eye, both the artist's and critic's – "architects [are] concerned with appearances … someone has to be." This makes good sense as far as it goes; the conclusion is obvious and irrefutable – it's incredibly hard to think otherwise. However, nothing close to the aesthetic enterprise I encourage in shape grammars comes up – do calculating, and art and design combine some way, coadunate in an aesthetic relationship? I guess that not posing the question is a tacit way of firmly answering, no – who would dare the opposite? Art and design go farther than computers and calculating – isn't that what art and design are for? The current paradigm is safe, eternal and totally unprepared for change. Of course, there are always hats, separate but equal – one for computers and calculating and one for art and design. A few look smart in both hats and enjoy them on different days, not seeing that they inform each other, more productive as one than two. Wearing two hats one at a time omits individual differences and flaws that dissolve mutually. This is the how and why of shape grammars, that won't accept no for an answer. Shape grammars overtake computers to make designing things possible in art and architecture alike, when they exploit seeing that's rife

with ambiguity, anywhere the eye may fall. It seems to me that without new perception and a meaningful way to explain it, there's no cause to worry about art and design – there's nothing to say about pictures and poems, and whatever they evoke to each of us. And what better way to understand the ins and outs of how this works than in visual calculating that allows in everything you and I see? In one way or another, this is ongoing. Leon Battista Alberti (architect, artist, and theorist, reputed author of the *Hypnerotomachia Poliphili*, expert cryptographer, humanist, linguist, mathematician, philosopher, poet, priest, raconteur and not infrequent dinner guest, Renaissance man – actually, what wasn't he in/as a single soul?) kept to this aesthetic (perceptual) standard six centuries ago, in his dialogue "Rings" –

> [The] eye is more powerful than anything, swifter, more worthy; what more can I say? It is such as to be the first, chief, king, like a god of human parts. Why else did the ancients consider God as something akin to an eye, seeing all things and distinguishing each separate one.

No one doubts that God is fickle, "seeing all things and distinguishing each separate one" differently at different times to suit him/herself in his/her own special way – it's God's world to re-create. We attribute to God what impresses us most about ourselves and surely, he/she reciprocates. God's way of seeing things and ours overlap – this goes both for the definite things God/we pick out (the vast array of everyday perception) and for the flexibility he/she/we have to see again in another way (artistic/poetic imagination). Nonetheless, not everyone welcomes the idea that artists and designers are gods, when there are mundane appellations that work as well. (It's easy to find names in a range of choice from polite to impolite.) Some tell me that it's brazenly aristocratic – capriciously changing your mind about what you see in order to design, without rolling up your sleeves and getting your hands dirty. But even if this is true, it's an aristocracy of perception and the senses, that invites effortless participation at any time, from anyone who cares to join in and take part. Art and design aren't simply making – they demand more than craft (assembly, manufacturing, 3D printing, etc.) that relies on numbing practice and monotonous repetition. Making doesn't explain readymades and *objets trouvés*, and what happens in photography and elsewhere, when pictures are taken and only made later, after finding time to look at them. Maybe all pictures/paintings are truly

readymades. Nor do clever concepts worked out fully in advance exhaust art and design; nor does cognition (discursive language and thought no matter how they're defined – with a recursive syntax in a vocabulary of word-like elements or atoms, or with mappings in an algebra of semantic units). Once concepts and the results of cognition are fixed and stored in memory for future use, to recite by rote, very little if anything is left to/for the imagination. That's where art and design end – you've been told exactly what to see, and thoroughly trained that it's wrong to forget. Once rules are learned, they're meant to keep. No, that's not how it is – new perception (looking) is first and foremost in art and design, time and again for description and representation that alter freely and flexibly to inform making, concepts, cognition, etc. in the untold inventions of mind and hand. New perception is why pictures and poems overflow, and exceed our prior expectations – there's ongoing access to everything that hasn't been seen or experienced somehow. New perception is what visual calculating in shape grammars is for. I like to think that the miraculous winged eye on the reverse side of Alberti's portrait medal, cast by Matteo di' Pasti around 1450, is a fitting image of this, in the force of its wings, and in its fantastic lightning bolts and sunbursts – as a symbol of vigorous creative activity that invariably illuminates in a flash of insight and a surge of imagination, to see in varied and expansive ways that continually renew and enrich the soul. The relentless pulse of the winged eye in untethered flight, wingbeat after wingbeat, is, in fact, the throb of new perception in visual calculating – on and on, in sync with the "embed-fuse cycle" in which rules apply in shape grammars. I want to reveal the magic in this, as I show how rules work in the embed-fuse cycle to lift the winged eye in a census of what there is to see, to assimilate in order to re-create. The joy of flying diminishes the incumbent risks, terrible and sinister ones in creepy spying to coerce and control, and to crush the soul in rote reply, in a planned out and neatly ordered world. Art and design break away and veer off, irrepressible in visual calculating; this much is always for sure in shape grammars – the embed-fuse cycle is unbounded, full of ambiguity and ready for change. The trick is to really look, so that things always feel different as rules are tried, and not to worry if this agrees with anything fixed in advance, whether in axioms or data. There's no rhyme or reason to it – visual calculating isn't thinking that's snared in logic or statistics. The winged eye swerves this way and that, free in an inconstant and unknown path to create with no limits, "more powerful than anything… seeing all things and distinguishing each separate one." In art and design, there's more to see whenever I choose to look; the winged eye never touches ground –

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Alberti's motto – QVID TVM – below the winged eye is sometimes rendered as "what next." (In addition, QVID TVM is "what then" and "so what." The latter makes light of Alberti's illegitimate birth given his outsized success in life – origins are irrelevant. The same is true for seeing and for visual calculating in shape grammars.) As ecphonesis, "what next" may betray the sheer exasperation of those who urge panoptic surveillance (spying) – at the impossibility of classifying everything we see and do, even with mountains of prior (past) data in superfast computers with vast memory. No doubt, it's prudent to purge what doesn't fit in – uncommon perception and outlandish behavior that shock and offend, telltale signs of mental decline and moral decay that bring nothing except misfortune and despair. For everyone's health and well-being, seeing and doing should be taught, prescribed for all to get within limits (red lines) set firmly in place. That's the reason for official art, properly sanctioned and unquestioned. But QVID TVM also goes for Alberti, perfectly for his twin passions of counting and seeing – and in each, there's something unknown. On the one hand, "what next" is an arithmetic query about sequences and secret codes, and finding a pattern in a network of numbers and relations. The goal is to predict from prior experience and results – today, for example, with C. S. Peirce's abduction to guess instinctively for scattered data, or with machine learning's statistical methods to decide effectively for big data. Then on the other hand, "what next" is the aesthetic impulse to look again as if purely by chance, to see (observe) in a different way, so that whatever you find is a surprise, noticed before or not. The goal is to perceive in total ambiguity. Somehow, prediction and perception are largely at odds – miles apart. The kind of analysis true in rules (formulas and mappings)

defined/discovered for counting is only dull censorship for seeing (von Neumann frames this split in terms of visual analogies and the Rorschach test – the regularities in the former eschew the random/personal quirks of the latter). There are no formulas or mappings for pictures and poems. The conclusion is routine – intuitive for artists and critics alike – yet it may not mean what you think. Seeing is no less calculating than counting – both are recursive, and in fact, counting is a special case of seeing, that's right for computers. In what comes next, counting ($i = 0$) and seeing ($i \geq 0$) trace a continuous arc from symbols to shapes – applying rules to add numbers and concatenate symbols in customary ways, and applying rules to see shapes and change them in extravagant, strange and wonderful ways for endless pleasure and delight. This grand synthesis extends calculating past computers to traverse imagination's magical realm – shapes beyond numbers and symbols. And this is the locus, too, for the many drawings that I've used in "Seven Questions" and in my exhibits, that play their full roles as active parts of sentences made up of symbols and words. It's good to copy these drawings freehand as you read, and to intercalate between them in your own drawings and sketches in rich marginalia, in order to calculate from one shape to another, to prove step by step what you see. In visual calculating, seeing informs drawing in countless ways, in an integrated process that enfolds open-ended ambiguity in its each and every swerve. Nothing is ever fixed; nothing important is taught – things of value alter as I go on. With rules, I do exactly what I see. The real test for calculating, both visual and not, isn't so much to take in what requires training and expert knowledge or to encode everyday habits and common sense, but to embrace imagination and everything extravagant and odd, neither settled nor known. This isn't about mind and making things (hand), or ethics and morality; it's about what's good for the eye (art and design). That's why shape grammars are special, and why they work the way they do – that's what they're for.

George Stiny

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questions framed in new ways, and with offbeat material and oblique perspectives to assimilate – a seminar of eight adds an extra 16 eyes that multiply and compound in neat ways year after year. It's been a diverse group – beginning graduate students, visiting ones, and ones returning time and again, and also established academics at sundry universities in the United States and from many places around the world. Then there were a myriad conversations with Lionel March, and with James Gips and Edith Ackerman that reached their ends over the past few years – it seems that death is vast silence and lost friends. I miss them – in both ways it ("them") refers, as friends and for what they had to say. Nowadays, I feel their influence in the way I re-create their words in fluid memory – this is the reason for ongoing conversation that always has special shortcuts, and restarts full-strength anywhere you wish and jumps wherever you want it to go, to provide the push and pull to traverse an expanding and ever-pulsing landscape in order to see things anew. And of course, there's the Greek axis – Alexandros Charidis at MIT, and Sotirios Kotsopoulos at the National Technical University of Athens (NTUA) and also MIT. They read "Seven Questions" at various times, and offered invaluable suggestions and sound advice as it took shape in its present form. Sotirios tried many versions of "Seven Questions" in his classes at the Polytechnic, providing incisive feedback. Moreover, he insisted that I read W. H. Auden's "Journal of an Airman." (Auden read a different poem at Harvard in 1946 – "Under Which Lyre: A Reactionary Poem for the Times" – in which the "sons of Hermes" and "Apollo's children" are locked in awful strife over idle tricks and useful technology. "Precocious Hermes" pits his lyre for pictures and poems against "pompous Apollo's" lyre for planning and an ordered/arithmetic world. This "fanatic" clash of half-brothers and two cultures – thesis and antithesis – defines new pairs that match shapes and symbols. Today, computers and data claim Apollo's victory and dismiss Hermes, but in shape grammars there's a synthesis instead – with unrivaled agility, Hermes rings Apollo, full of tricks to subsume technology. This is straightforward when $i \geq 0$, and a tad harder when $i \neq 0$ – the extra effort shows that lines, etc. also work like points.) Alex did the drawings that take this book from mere words to something grand to see, rendering my rough sketches in well-crafted lines and planes in order for these shapes to attract the eye and to hold its focus – to show how shape grammars work visually, in the best possible way. And additionally, he put up with my drifting moods and the visual changes they invariably implied, as he made sure that everything repaid seeing, and looking again time after time.

On the imagination, or esemplastic power

The IMAGINATION then I consider either as primary, or secondary. The primary IMAGINATION I hold to be the living Power and prime Agent of all human Perception, and as a repetition in the finite mind of the eternal act of creation in the infinite I Am. The secondary I consider as an echo of the former, co-existing with the conscious will, yet still as identical with the primary in the *kind* of its agency, and differing only in *degree*, and in the *mode* of its operation. It dissolves, diffuses, dissipates, in order to re-create; or where this process is rendered impossible, yet still at all events it struggles to idealize and to unify. It is essentially *vital*, even as all objects (*as* objects) are essentially fixed and dead.

FANCY, on the contrary, has no other counters to play with, but fixities and definites. The Fancy is indeed no other than a mode of Memory emancipated from the order of time and space; while it is blended with, and modified by that empirical phenomenon of the will, which we express by the word CHOICE. But equally with the ordinary memory it must receive all its materials ready made from the law of association.

– S. T. Coleridge

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