CHAPTER 9

Constraint in artistic aids and practices [1]

Introductory

If we want to be creative, we will have to free ourselves from the constraints of old ways of doing things in order to go beyond them into new territory.

In this chapter, we take a step towards the goal of a practical understanding of how this might be done. It starts with my telling how I stumbled on the intuition that constraint may be a necessary condition for entering the unknown, and provides examples of how the community of artists, whether consciously or not, have made much use of this possibility. Eventually I found myself coming to the seemingly paradoxical conclusion that constraint is necessary if we are to achieve either meaningful freedom or creative self expression. I also came to realise that the use of constraint is one of the guiding principles of our evolution as a species.

My approach to going deeper into the creative powers of constraint, starts with account of how I came to realise their central importance. I use the particularities of my own story because of the insights it furnishes relating to the creative process in general: long periods of gathering data, struggles with the confusion that they seem to engender, a sudden intuition that provides a lead on how order might be found and, finally, doing the work necessary to test its validity.

The inspiration for my breakthrough came when reading a book by J.J. Gibson, one of the most controversial yet influential perceptual psychologists of his day.

An ecological approach to visual perception

At the University of Stirling, after completing some sixteen experiments, carefully designed to tease out answers to various questions relating to different

1 This chapter is a revised version of: Pratt, Francis, 1985, "*A perspective on traditional artistic practices*." In, "*Visual Order. Studies in the Development of Representational Skills*". Eds: Freeman, N.H. and Cox, M. Cambridge University Press.

aspects of drawing skill, I found myself overwhelmed with sheets and sheets of computer print-out, filled with seemingly endless examples of statistical significance. However, the gap between statistical and real significance can be large and I hardly knew where to turn. My head was spinning with confusion and my courage was failing. In my desperation, the only idea that offered itself was to retreat from the battle in the pusillanimous and vague hope that, by some miracle, something would turn up. I spent my time going for long walks over the local hills and reading around. Amongst the books I discovered was J.J. Gibson's last and definitive work, *The Ecological Approach to Visual Perception*.[2]

The book is the Author's way of summing up a life's work. It combines scathing attacks on the traditional ways of doing experiments in the field of visual perception and a summing up of an alternative approach to the subject. The *guiding principle is that eyes are tools for useful interaction with the physical world*. From this comes the emphasis on the essentially dynamic nature of information pick-up and a focus on a mobile visual apparatus.

Instead of investigating the world in terms of objects, Gibson recommends investigating it in terms of useful properties, which he terms "*affordances*". For example, rather than thinking about chairs as such, he suggests considering them as "*surfaces which afford sitting on*". Similarly, he proposes that cups should be thought of as "*receptacles which afford drinking from*". In this way an enormous number of disparate objects can be subsumed into the same classification. Thus, all, weight-supporting, horizontal surfaces of an accessible and comfortable-to-sit-upon height can be used as seats; and all nonporous, concave receptacles, capable of holding liquid and being conveniently held in the hand, afford being drunk from. The potential advantage to researchers of this highly parsimonious idea is enormous for, by it, huge simplifications in the basic tasks confronted by visual processing systems can be made.

The idea of defining aspects of the visual world in terms of affordances and real-world usefulness (what Gibson termed "*ecological validity*") had a very important spin-off consequence. It added new fuel to the fire of Gibson's sweeping criticisms of the traditional laboratory experiments in which vision had been studied under extremely artificial conditions.

A striking resemblance

In general, I found Gibson's book a great pleasure to read and, on the whole,

2 J.J. Gibson, 1980, The Ecological Approach to Visual Perception, Houghton Mifflin.

his ideas were convincing and sympathetic. However, because my response to his ideas was constrained by my having the mind-set of an artist, I found myself confronted by a fundamental sticking point. In some ways its seemed like a rerun of my brush with the *Theory of Intellectual Realism*. The problem arose with the realisation that there is a striking resemblance between the structure of traditional laboratory experiments and the use of the perspective frame, the former derided by Gibson as having no ecological validity and the latter used widely by artists, including such acknowledged creative geniuses as Dürer, Leonardo da Vinci and Vincent van Gogh. What could this similarity mean? Was it conceivable that Gibson might be wrong? I sensed that I had stumbled upon a very interesting line of thought and it was to become more intriguing and exciting as my mind began to get to grips with it. In the end, the conclusion was forced on me that Gibson had come very close to throwing the proverbial baby out with the bath water. He had compromised his conclusions in two ways: He had neither followed his own logic far enough nor paid enough attention to what goes on inside the head. Let me elaborate.

Gibson criticised the traditional way of doing experiments in visual perception on the ground that the experimental conditions used in them excluded too many interactions of the kind that would naturally occur in daily life. According to his ideas, this rendered them virtually meaningless in terms of real-life perception. He asserted that the traditional approach, by severely limiting viewing circumstances, greatly impoverished the structure of visual input. In order to flesh out his point he listed six ways in which the traditionalists regularly constrained the people doing the experiment. Thus::

1. Their heads were *immobilised*, possibly using a headrest or bite board.
2. They were only allowed the use of *one eye*, possibly having to peer through a very small aperture (an 'artificial pupil').
3. They were required to react to a *stationary model*.

The model was:

4. *Abstract.*
5. Displayed on a *two dimensional surface*.
6. *Presented for but a fraction of a second* (either tachistoscopically or by computer instruction).

At first sight it looks as if Gibson has a point. If constrained in so many

ways, what could vision have to do with the everyday use of the eyes? However, quite unexpectedly, a thought jumped to mind that gave me pause. Gibson's list was almost identical to one that could be applied to the constraints imposed on themselves by artists when using a perspective frame. *Figures 1, 2 and 3* between them illustrate the essential properties of one of these much used artistic devices and provides a context for my explanation of what I had realised.

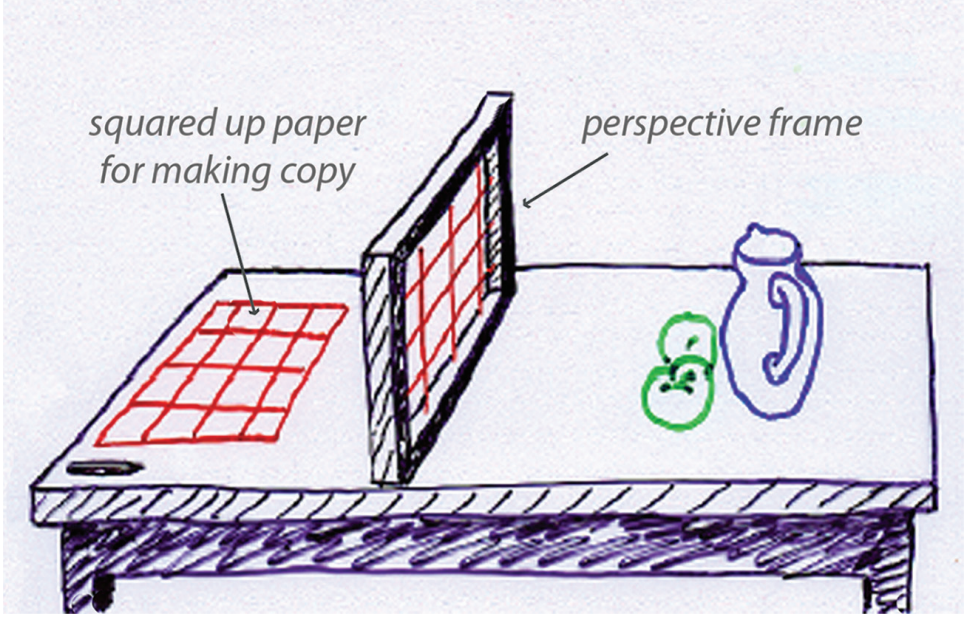


Figure 1: A basic perspective frame (no chin rest or aligning device illustrated)

As illustrated *Figure 1*, the perspective-frame consists of a rectangular frame, usually made of wood, across which are strung wires or strings, so that they form a grid of rectangles. The artist looks through these rectangles at a model (*Figure 2*) and uses them as frames of reference to aid judgements of curvature, angle, length and position. The aim of the exercise is to produce an *accurate* copy of the model on a piece of paper. This copy can be described as a "*secondary-model*" for it is not intended as a finished work of art. Rather it is meant as an intermediary stage. Later it will be used for redrawing the image on a picture support, usually on a larger scale. Before actually starting work on this secondary-model, the artist draws a grid of lines on the paper upon which it is

to be depicted. These lines create rectangles analogous to the rectangles created by the wires stretched across the perspective frame. This correspondence greatly facilitates the necessary judgements of curvature, angle, length and position.

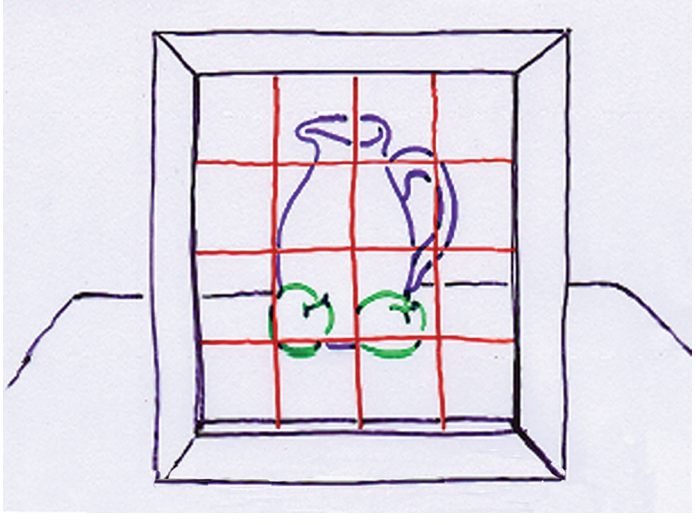


Figure 2 : Looking through the grid

Figure 3 : Looking through one rectangle

For effective use of the perspective frame, artists must observe certain constraints. If they do not, the grid references will become unreliable. Thus, they must:

1. Remain *immobile*, possibly using a chin rest or other aligning device.

2. Use only *one eye*, possibly looking through a small hole (as in the case of a version used by Leonardo da Vinci).
3. Looking at a *stationary model*, viewed through a grid.

The function of the grid is to enable artists to work on their depictions one rectangle at a time (*Figure 3*). Dividing up the image in this way encourages the perception of the model in terms of parts and aspects which tend to escape attention when a model is perceived as a whole. Moreover, the analysis of relations between the model and the grid are fundamental to the usefulness of the perspective frame because these are essentially abstract. Thus, the artists ensure that they see their models in:

4. As *abstract* a manner as possible.

The degree of abstraction is greatly increased in the secondary-model, particularly in the earlier stages of its production, since it consists of lines drawn on:

5. A *two dimensional surface*.

On the evidence of this list so far, it would seem that artists freely choose to submit themselves to five of the six constraints imposed upon people doing the archetypal laboratory experiment, as described by Gibson. The only missing limitation seems to be the very brief viewing time. However, it can be pointed out that, although artists using perspective frames are at liberty to look as long as they wish, the video-tape record described in *Chapter 5* indicates that acts of line-production are characteristically accompanied by a minimum of very brief glances, the duration of which is only:

6. *A fraction of a second*.

The puzzle and the intuition

So, what are we to make of all this? Either it is necessary to argue that the use of the perspective frame, even in the hands of artists of the calibre of Dürer, da Vinci and Van Gogh, has no creative possibility or it is difficult to escape the conclusion that creativity can at the very least survive the restrictions in question.

Having arrived at this stage in the argument it was not a big step to the intuition that constraint, far from inhibiting creativity, might actually encourage it. Indeed, egged on by the temptation to take the idea to its limit, it was difficult to avoid entertaining the possibility that *restriction might be essential*

to creative looking.

At the time these ideas first entered my head, they were ill-formed and vague. However, they had that euphoric feel of being right that rushes in before it is really justified. However, it impels one to persevere. This confidence is clearly *a form of self-deception*, but it is amazing how often it turns out to be well founded. The problem arises only if this importantly emotion-based response pushes people to spend long hours, days, weeks and even years in pursuit of a shadow. However, in my case, right or wrong, I was energised to go forward and what better place to start than with an investigation into the nature of traditional artistic practices. I fully believed that making a list of them would give support to my hypothesis. Below is the result of this exercise.

THE LISTS

Choosing a subject

First the artists must chose a subject. Since all scenes vary in their physical properties and spatial layout, it is clear that each will provide different kinds of visual information. Thus, a bowl of fruit, seen from close-up and in clear lighting conditions, will activate all the eye/brain systems used for mediating analysis of for nearby, stationary objects. In contrast, a distant and misty flat wall, viewed front-on will activate few if any of these. This is because a combination of flatness, distance and mist renders inoperative all visual systems depending on either texture or overlap.

Setting up the easel

After selecting the scene to be depicted, artists set up their easel and on them place a canvas or a drawing board with paper attached to it and settle down to paint or draw. Some prefer to stand and others to sit, which means using some sort of a chair. In this way, the relativities between the artist, the depicting-surface and the scene-being-depicted are established and new complexities are introduce into the situation. Most of these will be considered later, however, an example will give a flavour of the situation. One of the problems in accurate depiction is establishing reliable vertical and horizontal axes of reference. There are many ways of doing this including the use of the side and top edges of the drawing board as vertical and horizontal axes, which can be related

to features in the scene being depicted. However, the task of establishing these relationships will be impeded if both eyes remain open. Stereopsis separates out the drawing board from its background so effectively that it becomes difficult to compare the two. Shutting one eye brings an immediate improvement, since one-eyed vision, by inhibiting stereopsis, enormously facilitates the task.

Getting down to work

Once the preparations are completed, the artists gets down to work. An observant bystander may notice several significant behaviours. For example, they are likely to:

1. Stand or sit fairly still and, maybe, they will shut one eye.
2. Sway their heads very slightly from side to side, as they align two features in the scene (one in front and one behind) to give him a definitive fix on their viewing position.
3. Screw up their eyes in an attempt to simplify the array of colour contrasts.
4. Lean forward to examine details of their emerging depiction.
5. Stand back a few paces as a means of getting a better idea of whole-field colour relations.

All these actions have important effects on the array of information available for processing and, as a result, all deprive the artist of potential sources of visual information. In other words, all constrain perception.

The bystander would have to be extremely observant to notice the patterns of the artists' eye movements. However, there is little doubt that these would conform to the picture provided by the video-tape record obtained for the copying accuracy experiments described in the previous chapter. There would be a mixture of short glances and longer looks, with the former only giving time for either one or two fixations and the latter indicating multiple-fixation looks. It has already been emphasised that the fragility of short-term visual memory means that a lot of information is lost when multiple-fixation looks are used and more will be said shortly about what is lost and gained by one and two fixation glances. However, the point that needs to be made here is simply that, even at this level of description, different visual behaviours involve a trade-off between something gained and something lost. Similarly *though movements of the head and body*

can provide visual systems with much useful information, they will simultaneously deprive them of a great deal.

One implications of this last conclusion is that it would be possible to imagine Gibson's critique of traditional experiments requiring to be made in reverse. For example, this would be the case if history had been different and the pioneers had started by taking advantage of movement-generated visual information and only later had someone discovered the potential of single eye, stationary visual systems. Both Gibson and the traditionalists that he inveighed against were severely constraining their experiments, whether as a result of standing still or as a consequence of being in motion, and the former's attack on the latter was much weakened by the fact he showed no sign of realising this.

If anything, was wrong with the approach of the traditionalists, it was their failure to *relate the experiments to real-life visual tasks*. Gibson's main, fundamentally important and lasting contribution to the study of visual perception is the insistence on taking into account the *functional context in which the visual-systems are being used*. For example, he showed that pilots who are approaching runways at speed, by the very fact of their motion, have access to visually mediated information of a kind that is neither available nor useful to stationary artists. Without it they would crash their aircraft. However, if the great man had thought about the nature of the artists' task, he would have realised that it is very often precisely the artists' lack of motion that facilitates their activity.

In summary, all the artistic aids and practices so far described achieve their aim by transforming the visual task confronting the artist into one that enables them to make use of the visual systems which provide them with the best chance of satisfactory results. *The selective and appropriate use of visual systems is the key to their skill.*

Artificial aids

Artists, as they work, either on site or back in the studio may use any one of a number of artistic aids or some kind of free drawing strategy. All of these can be seen as means of overcoming the very real problems faced by all who try to copy objects accurately. The evidence presented in the previous chapter makes it clear that everyone has very poor capacities for making the necessary judgements of curvature, angle, length and position. In the book on painting in this series of four related volumes, it is argued that a similar predicament obtains for those

who engage in the analysis of colours and colour-relations.

If artistic aids and practices are based on ways of giving priority to the most appropriate visual systems, it is not surprising that they all constitute variations on a small number of themes. Here is a list of them, including the already featured perspective frame. They can be divided into three categories, although there are many overlaps, where one device has different functions that need to be put under different headings. Thus, there are those designed to facilitate drawing images *directly* and those that do so indirectly, either via the creation of *a secondary model* or by making use of *the emerging artwork itself*. Let us take each of these in turn.

DIRECT

Over the centuries, artists have regularly used :

1. Various gadgets for projecting images onto the picture surface so that they can be traced. The earliest of these was the *camera obscura* which is essentially a dark-room or box with a small aperture to allow in the light from the exterior. By means of a lens/mirror arrangement, an in-focus, right-way-up and right-way-round image of view outside can projected onto a piece of paper or canvas situated inside. The image can then traced. A *camera lucida*, is a nineteenth century extension of the same idea using a prism instead of a lens. Its virtue is that it can be carried around and used on location, while its shortcoming is that it can only deal with a small part of the image at a time. More recently, *slide projectors* have tended to replace these earlier immobile or cumbersome possibilities. However, as these require the intermediate stage of making a transparency it is not strictly speaking a method of direct transfer. Today, the computer generated images are widely used.
2. *Plumb lines*, that is to say, a weighted bit of string which, when held up in front of the scene being depicted, provides a reliable vertical reference.
3. Simple *viewing frames* made by cutting a rectangular hole out of piece of cardboard of the same proportions as the proposed finished work, through which the scene to be depicted can be viewed. This device is used both as an aid to selecting a composition and as a way of provid-

ing vertical, horizontal referents. Though not a frame, the drawing board itself is often used as a source of vertical and horizontal referents. Its advantage is that it is always available.

4. The *body of the depicting instrument*, whether it be a pencil, a pen or a paint brush, held at arms length, at various angles to provide a flexible reference against which angles and proportions can be better judged. The system is greatly improved by the fact that the thumb or finger can be moved up and down the length of the depicting instrument to act as a variable gauge. Unfortunately, there are a whole battery of ways in which its use can lead to errors.
5. The *tip of the depicting instrument*, used as a marker, that is to say, a movable point of reference that can be related to other reference points on the picture surface and placed according to the needs of the moment. This can be particularly useful for prejudging relationships on the artwork.
6. *Devices for reducing the range of colour and tonal contrasts*. The best known of these is perhaps the *Claude Glass*, named after the French landscape artist, Claude of Lorraine. This is essentially a black convex mirror which reflects a view in miniature. It is the black colour of the device that ensures the reduction in the range of colours and tones. Other ways of reducing the range of colour and tonal contrasts include viewing the scene through a lightly frosted glass or a muslin screen.
7. *A narrow tube through which scenes can be viewed a bit at a time*. This enables artists to pick out individual colours and analyse them independently. This simplest of devices was used by the Venetian colourists as a way of overcoming distortions to colour appearances which occur in all in complex scenes. Paradoxically, the same device can be used to become aware of subtle colour differences between similar colours. The reason is that it inhibits the levelling effect of colour constancy.[3]

INDIRECT

1. *Squaring up* (that is to say making a grid of squares) both the secondary-model and the surface onto which it is to be transferred. If this is done, the two grids can be used as frameworks of reference. Squaring

3 *Chapters 13* and *14*

up can be used as a method for enlarging the image size (as, for example, might be needed if the secondary-model was a small photograph or a view-size sketch). Enlargement will result automatically if the relativities within the squares are the same and the squares on the picture surface are larger than those on the secondary model.

2. *The perspective frame* (as illustrated in *Figure 1* above) the purpose of which is to draw an already squared up secondary model, which can then be transferred to another support. It comprises a number of wires or strings stretched across a rectangular frame in such a way as to create a grid of squares which both divide up the model into easier to deal with chunks and function as a reference grid. Not illustrated is the means to keep the eye stationary, whether it be an aligning device, a chin rest or a peep hole.
3. *A tracing glass*: a piece of glass on which an image of a model seen through it can be traced. A grid of lines can be drawn of scratched onto the glass as referents.
4. *A mirror*, which provides a reflection of a model that can be traced, either directly onto the mirror (as done by Brunelleschi) or copied using the mirror frame as a reference. The size of the image can be controlled by the distance between the model and the image. In these two way the problems of size constancy can be considerably reduced. A much used example is the above mentioned *Claude Glass*. Its convex shape meant that large landscapes could be reduced to more easily manageable relations.
5. *The camera* which, by automatically producing a photographic print, creates a veridical, two dimensional copy for use as a secondary-model. The photograph can be squared up to ease the problems of copying, particularly since the copy will almost always need to be on a larger scale.
6. *An aligning device*, as sometimes used with a perspective frame, employed as a method of establishing the artist's viewing position. Often two features in the scene being depicted can serve in this function.
7. *The eye*, for by far the most common method of making secondary-models is, of course, the freehand preparatory sketch. Also, the traditional academic method required the production not only of numerous studies but also of a cartoon, which provided an exact scale drawing of the

proposed painting and an ébauche which provided a roughed out version of its colours. Many traditional teachers recommended that preparatory sketches done from the model should be 'view-size'. The meaning of this term is that, from the viewpoint of the artist, the sketched image on the drawing board should subtend the same angles in the eye as the model. This greatly helps accurate comparative looking between model and copy.[4]

8. *Existing paintings and drawings*, for artists have by no means always produced their own secondary-models. There is a long and distinguished tradition of using the work of other artists, whether they be paintings drawings or prints, both as models and as sources of information.
9. Various methods of *transferring,* which is the technical term for applying chalk, charcoal or graphite to the reverse side paper on which the image is drawn, laying it the right way up and tracing those parts of the image that require transfer. In this way pigment on the back of the paper is detached and lines are produced on the picture-surface below. This process was much used by Degas, amongst many others.
10. *Pouncing*, which is the technical term for pricking holes along the lines drawn in the secondary-model, then dusting a fine powder of colour onto the surface. Where this penetrates the pricked holes, a row of dots, corresponding to the pounced lines, appears on a picture surface placed below.
11. *Tracing,* whether using transparent tracing paper or a light-box. Both methods provide a convenient way of developing studies; while the latter enables the transfer of images onto thicker paper, suitable for a final picture.
12. *The ruler*, which can be used to cross-check measurements in the model and the copy.
13. *Various mechanical methods*, most of which have the additional advantage of enabling enlargement. Old and cumbersome devices like the pantograph have now been largely replaced by methods based on modern technology such as slide projection and photocopying.

4 The the use of the mirror as a scaling device performs a similar function.

THE EMERGING DEPICTION

As well as the aids discussed above, there are several aspects of the actual process of drawing or painting on a flat surface that are likely to constrain artists into new ways of looking. The videotape record of the people doing the experiments described in *Chapter 5* showed that they spent about half their time looking at the scene they were depicting and the other half looking at the depiction itself. Evidently, looking at the depiction helps. The question is, how? And the simple answer is by means of *visual feedback*, but this has many manifestation. The list below gives an idea of some of the factors which are likely to be involved:

1. *The medium chosen* for making a painting constrains both the kind of marks that can be made and the range and character of colours that can be used and this fact alone can influence visual behaviour in significant ways. Thus, the prospect of using a pen or a pencil will be likely to stimulate scene analysis in terms of contours, while the prospect of using paint and brushes might well place a priority on analysis in terms of relationships between regions of colour. It is worth emphasising that neither of these looking strategies is commonly used in everyday life.
2. *The completion convention*. When artists get down to work, they will usually have preconceptions, however vague, relating to the sort of picture they will end up with. These will not be the same for a sketch as for a highly finished painting but, in either case, they will force ways of looking that are very different from those customarily used in everyday life. In particular, artists regularly (if not always) conceive of a finished painting as covering the entire picture surface. This means that, in addition to the elements of the scene which immediately catch their attention, they will be forced to look at the spaces both around and in between them. The contrast with everyday visual analysis, which gives priority to minimal looking strategies and separating objects from their context, could hardly be more striking.
3. *The flat picture surface*. Pictures are produced on flat surfaces. This means that a number of visual systems are rendered inoperative with respect to the analysis of their content. These include all those systems which depend on motion, binocular vision or focus, since all these can only perceive a flat picture-surface as being what it is, namely a flat surface at a certain distance. Thus, for example, perception of 3D space

in paintings can only be achieved by means of cues capable of being mediated by a single stationary eye. In practice this means cues depending on overlap, relative size (in particular, linear perspective), cognitive and colour-based cues.[5]

4. *Fragmentation*. Pictures are created out of a collection of marks which are made a bit at a time. Particularly in the early stages of production, the marks are likely to be noticed for what they are in their own right and, if so, they will be seen in terms of their abstract qualities. In this way, the very process of making paintings and drawings is likely to focus attention on qualities of line, texture and colour, which, in the finished painting, might be dominated by the image. Meanwhile the image is also being built up a bit at a time and this inevitably forces concentration on parts of objects and details.
5. *Reintegration*. The process of organising the marks into a finished picture involves analysis of relations, whether they pertain to size, position, length, curvature, textural characteristics or some aspect of colour. As these are all abstract relations, the making of pictures has an intrinsic tendency to focus attention on abstract qualities.
6. *Comparisons*. As just pointed out, the emerging depiction consists of a collection of marks. If the picture is produced on site, each of these marks can be compared to a corresponding feature in the scene being painted. To make these comparisons, the eyes of the depicter must move back and forth between the scene and the depiction. What happens when this is done is of such fundamental importance that it will be dealt with at greater length in more than one place elsewhere. For the moment, it is sufficient to say that same/different judgements force attention towards what is *different* and this is always an abstract property at a lower level of description.

LAWS OF NATURE

Artists have for a long time shown interest in ways of codifying aspects of the appearances. The best known examples linear and aerial perspective (both of which relate to the perception of objects receding into the distance) and anatomical structure. In this context, it is perhaps worth pointing out that artists who,

5 For more about the use of colour based cues in painting see *"Painting with Light"*.

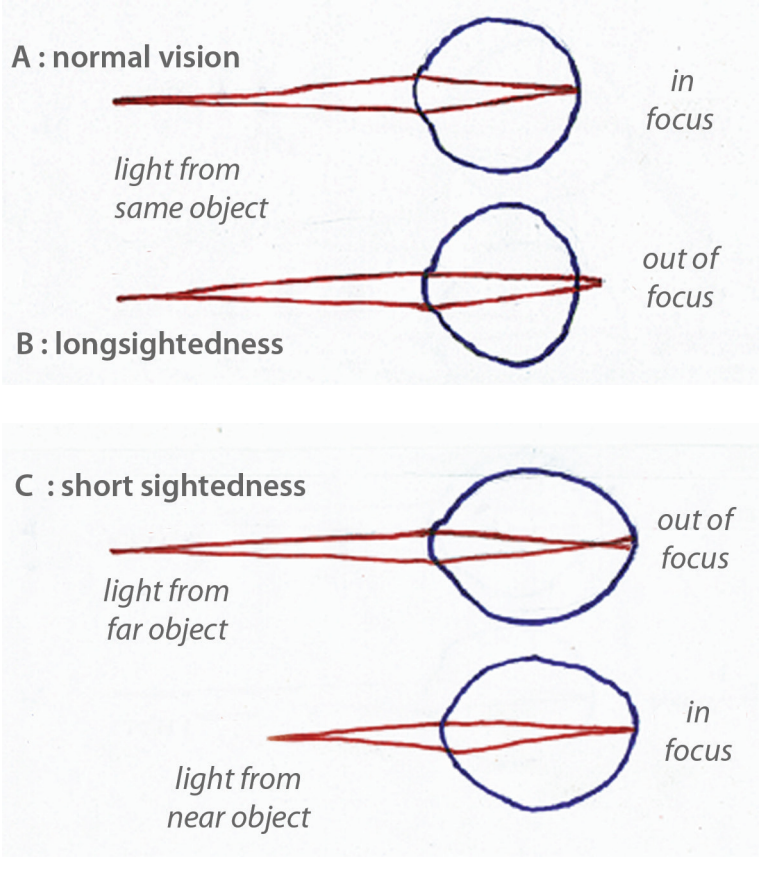
when drawing the two visible faces of a house, extend the two pairs of wall-top and wall-bottom lines so that both meet on the same horizon line, is doing so as an alternative to using visual measurements relating to the scene itself. The same applies to anyone who makes sure that the height of a head in a drawing divides exactly the right number of times into the height of the whole figure. The implication is clear: Artists using these kind of laws are doubting their capacity for making unaided visual measurements.

VISUAL *"DEFECTS"*

As well as the aids discussed above, there are various other ways that the structure of information coming into the eyes of artists can be constrained in potentially creative ways. Not least of these are those that are caused by what might usually be described as "*visual defects*". Such seeming shortcomings include myopia (shortsightedness), hypermetropia (longsightedness), amblyopia (lazy eye), cataracts, colour blindness, other anomalies in the retina and, finally, brain malfunctions, such as autism, schizophrenia and unilateral neglect. The role-call of artists suffering from such so called "*visual defects*" is very impressive.[6]

As an introduction to the list of defects, here is a short explanation of the two most common amongst them, *myopia* (shortsightedness) and *hypermetropia* (longsightedness). The main variable causing these phenomena is the length from front to back of the eyeball. Thus, the eyeball diagrammed in *Figure 4A* is of a normal length with the result that the light entering the eye from a point of the surface of an object is focused on the back of the retina. In *Figure 4B* the eyeball is shorter than normal. As a consequence, the same degree of diffraction results in the light being focused behind the retina and the image being blurred. In the top diagram in *Figure 4C,* the eyeball is longer than normal and the point of focus in front of the retina. Again the image is blurred. The lower diagram shows that if the longer-than-normal eye approaches the object it is looking at, there will come a moment when the same amount of bending of the light will bring its image into focus. Thus, its possessor sees better from closer and is referred to as "*short-sighted*". In contrast, there is no manoeuvre which can enable long-sighted people to regain focus. Their only solution is spectacles. The eye contains an inner lens (the crystalline lens) which has the function of adjusting for these variations. However, this becomes less flexible with age, explaining why the problems of long and short-sightedness are far more common in older people.

6 See Patrick Trevor Roper, 1997, *The world Through Blunted Sight,* Souvenir Press, London



Figures 4a, 4b and 4c: Illustrating normal, hypermetropic and myopic eyes

The list:

1 - *Myopia*

Unless corrected for, by the eye's inner-lens or by spectacles, a myopic artist, although able to see the emerging depiction clearly, cannot focus on the scene being depicted. Some have seen this as being an advantage to artists, particularly those with *Impressionist* inclinations. In support of their view, they can quote comments from Cézanne who, when offered spectacles, brushed them aside saying, "*take those vulgar things away*" and from Renoir who expostulated, "*My God, do you want me to see like Bouguereau!*"[7] Other Myopic art-

7 The most celebrated academic painter of the day.

ists include Monet, Pissarro, Degas, Toulouse-Lautrec, Bonnard and Matisse. Indeed, in the period when these men were at work, long-sighted artists of note seem to have been few and far between. The advantage of short-sightedness should increase with age since the eye's inner-lens ("*crystalline lens*") automatically corrects for poor focus until it becomes inflexible with age (that is to say, progressively, from the mid thirties onwards).

2 - Hypermetropia.

Unless corrected for by the eye's inner-lens or by spectacles, a hypermetrope can see clearly neither the scene being depicted nor the image painted on the picture surface (though the latter will be much more out of focus than the former). Famous long-sighted artists are hard to identify, but Dürer, Piero della Francesca, Leonardo da Vinci, Michelangelo, Titian, Rembrandt and Constable have been suggested as examples, while there is no doubt with Turner since his spectacles have been preserved. It is difficult to imagine a long-sighted artist refusing spectacles, since, as I can testify from my own experience, the unnecessary discomfort caused by looking at the picture-surface without them would, surely, never be submitted to if any alternative was available. This disadvantage usually becomes significant in the artist's later years, since the eye's *crystalline lens* automatically corrects for poor focus until it becomes inflexible with age (that is to say, progressively, usually from the mid thirties onwards). Indeed, the effect of ageing on hypermetropes is so universal that it has been given a separate classification as "*presbyopia*". The well attested difficulties experienced by the ageing Michelangelo, Leonardo da Vinci and Piero della Francesca, have been attributed to this cause. The main advantage of presbyopia may well be to posterity, since an inability of artists to see their subject matter clearly has been thought to contribute to the much admired looser brushwork that characterised the late work of Titian, Rembrandt and Constable. However, since this same loose brushwork has been praised as being *"better"* because it is *"more expressive"*, more artistic reasons for these artists' stylistic evolution might be worth considering.

3 - Amblyopia (commonly known as "*lazy eye*").

Another advantage of hypermetropia may result if it is so severe in childhood that it leads to amblyopia. A person with "*amblyopia"* is normally someone who in early childhood suffered from extreme longsightedness or shortsightedness that in-

terfered with the normal development of coordinated eye-movements to the extent that they never developed *stereopsis*. Luckily this deprivation is hardly a disadvantage for artists drawing nearby objects from observation.. Quite the reverse, since *stereopsis* makes the direct perception of figure/field relations virtually impossible. The lucky sufferers of amblyopia don't have to bother to close one eye when depicting. Dürer's famous squint, would suggest that he may have enjoyed this bonus.

4 - Cataract.

A cataract is a growth that clouds over the inner lens (*Crystalline lens*). Apart from causing loss of acuity, it filters out red light. The most famous authenticated case is indubitably Monet, who compensated for his defect by making his paintings much redder than hitherto. When his cataract was eventually removed, he was appalled by this redness, but many visitors to the Musée de Marmiton in Paris (including myself) have had a very much more positive response. Turner is another possible example, although, since the evidence comes entirely from the colours in his paintings, a more painterly explanation may be appropriate.

5 - Anomalous colour vision (commonly known as "*colour-blindness*")

Total colour-blindness is very rare, but does sometimes occur. By far the most common form of anomalous colour vision is characterised by a very poor capacity for discriminating between reds and greens. It is a hereditary, genetically determined condition which is caused by a lack of either red or green cone receptors and which is thought to affect about one tenth of all men. Various well-known artists have been tentatively classified as colour-blind, but mostly on flimsy evidence. However, though the visual experience of red-green colour-blind people is clearly very different from that of people with three cone-types (trichromats), it is far from the case that they lack experience of colour. Indeed, to judge from discussions with colour-blind students, taken in conjunction with some theoretical considerations[8], it seems that the colour experience of red-green colour-blind people may be more exciting in some respects than that of colour normals. Whether or not this be the case, when a colour-blind students insist that they are "*painting what we see*", they can produce colour effects which seem very striking and impressive to many trichromats. Although, on occasion, the outcome can seem rather drab to them.

8 To be discussed in Appendix A

6 - Other anomalies in the retina.

There is much discussion as to the causes of the eye problems that were eventually to be responsible for the short-sighted Edgar Degas going blind, but it is clear that they were very severe. In 1893, his optician prescribed spectacles that covered his right eye entirely and left only a small slit for the left eye to look through. It is said that he suffered a progressive loss of central vision, which would mean that he gradually lost the use of the part of the retina which is mostly densely covered with cone receptors, leaving him dependent on peripheral colour vision. If so, the outcome would have been a problem with bright light (which he was known to have), a diminution in the perceived brightness of colours and, an increased sensitivity to blue light (since the blue-green sensitive rod receptors would be brought more into play). Whatever the precise reason, the effect of Degas visual problems on his artistic production was marked. In 1886 he felt compelled to double the size of his paintings, while at the same time increasing the size of figures in them. Also around this time, profound changes were occurring in the colour range used in his work which, with the years became not only brighter and brighter. All this is consistent with a special form of anomalous colour vision. Since, unlike Monet with his cataract, Degas never recovered from his condition, we do not know how he would have reacted to these changes if, by some miracle, he had been able to see them with the eyesight of his youth. However, it is a moot point as to whether he would have responded as positively to them as his latter-day admirers.

7 - Anomalies in brain function.

Lots of things can go wrong in the brain for various reasons, whether to do with birth, accident or illness. It would seem that many of them have the possibility of giving artistic advantages. Four examples will suffice:

- The fairly common and much publicised phenomena of *autistic children* with special gifts for drawing (as there are also autistic children with special gifts for music, calculation, etc.).
- The abundant evidence that *schizophrenia* can produce very interesting pictorial outcomes (whether van Gogh's schizophrenia had anything to do with the development of his highly personal style is debatable, but far from out of the question).
- The ability of *dyslexics* to shine as architects and image-based computer tasks, suggests that their condition may well have advantages for artists

as well. Whether the dyslexia is born or bred, it involves a malfunction of systems associated with analytic looking. As will be explained later, this involves both focusing-down, imposing axes of symmetry and providing directional-indicators. A visual system deprived of it will be forced to give priority to whole-field, global analysis and awareness of patterns.

- The work of Lovis Corinth before and after the stroke which resulted in him suffering from *unilateral neglect*. In my view, a comparison between drawings done before and after this personal tragedy show that it was a good thing for posterity.[9]

BY-PASSING HABITUAL WAYS OF LOOKING

This heading could be used to describe all the aids and practices detailed above. However, there are a whole group of tricks, which are both routinely used in drawing courses and which regularly appear in how-to-draw books, that have scarcely been mentioned. Included amongst these would be three of the most useful, those that exploit *contour-drawing*, so called "*negative-shapes"* and *in front/behind relations*. Discussion of the very real advantages and the serious disadvantages of both *contour-drawing* and "*negative-shapes"* will be reserved for "*Drawing with Feeling",* my book dedicated to drawing, in which each of them is given a whole chapter. The value of using *in front/behind* references is emphasised in the same book, where a blow by blow account is given of a feel-based drawing lesson developed by myself, with the help of students, at the *Painting School of Montmiral*.

Implications

This chapter has shown how I stumbled on the idea that constraint may be a necessary condition for exploring new territory and provided examples of how the community of artists, whether consciously or not, have made much use of this possibility. It has also suggested that the use of constraint is one of the main principles in-built by evolution. Certainly, we have been endowed with a variety of independent visual and other sensory systems that, in addition to providing a range of back-up possibilities, give us a number of different ways of looking at the same thing, each of which provide a different modality of information. The

9 For more about Lovis Corinth see next Chapter

artistic practices mentioned are all about using different constraints as a strategy for controlling which of the systems will be informing us and which of the modalities will be given preference. Much more will be said on this fundamentally important subject in the following chapters.