CHAPTER 10

The drawing lesson: the first nineteen lines

Introductory

This chapter gives a blow by blow account of a lesson on copying the contours of a tree trunk. The instructions are very precise and the reasons for them are explained in detail. Though not strictly necessary, it will be an advantage to have read "What Scientists can Learn from Artists", Chapter 5 (Drawing Experiments), Chapter 12 (Constancies) and all the many passages concerned either with the various forms of memory or with analytic looking.

Drawing the first line

It is now time to draw the first line. In the interests of clear communication, I start by making an outline drawing of a tree which roughly corresponds to the outline of the tree shown in the photograph at the beginning of the last chapter (*Figure 1, page 85*).[1] However, it is always deliberately inaccurate (usually far more so than illustrated), so as to remove the temptation to copy it. For example, it might be something like *Figure 1*.

Thus prepared, I indicate the first line to draw. For this purpose, I choose a section of the right hand side contour of the tree that corresponds to the space between the top and bottom edges of the wall. In *Figure 1* this is indicated with an arrow and labelled "*benchmark line*".

Notice that the above description depends on relating something *in front* (the tree) with something *behind* (the wall). This kind of relation I call "*in front/behind relations*" and they will figure very prominently in what follows.

Before I allow the students to draw the line, I remind them that it must be produced *without any part of the hand touching the paper* and insist that it be drawn as *carefully as possible.*

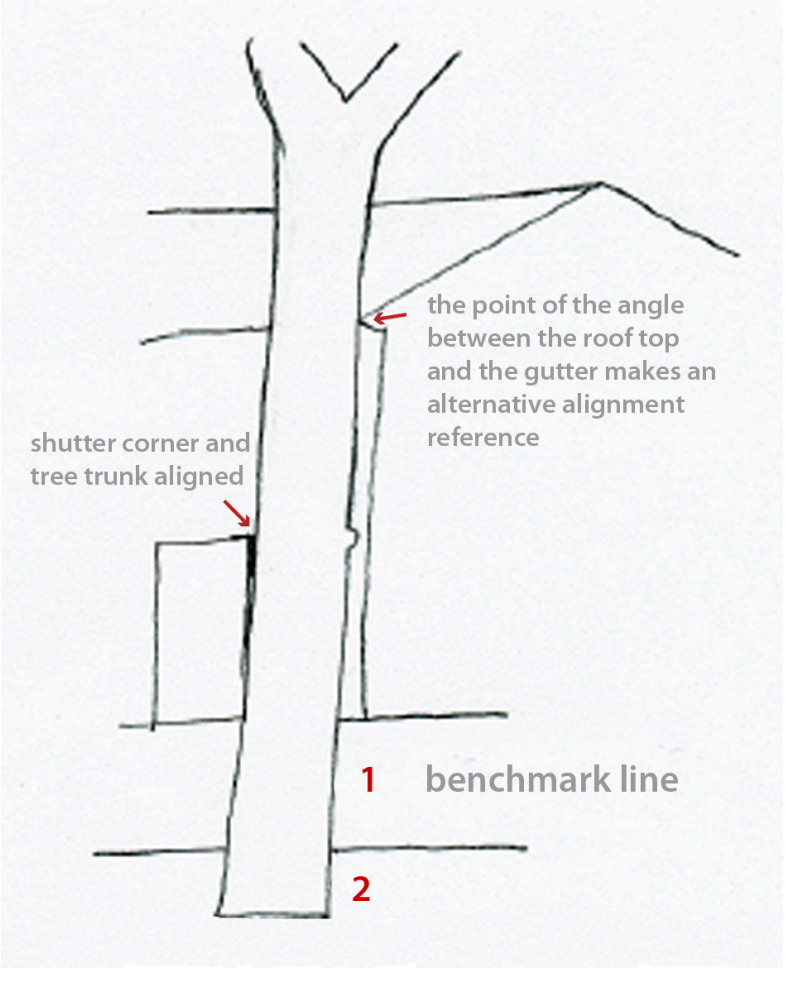

Figure 1 : Schematic drawing

When the students have completed this task, often having to overcome considerable problems of manual control,[2] I suggest that there is one property of the line which has been produced that will not be the same for any other line to be drawn from now on. I ask if they can think what this might be and, if no answer is forthcoming, I explain that the unique property is that, with respect to its length, *it will be correct*. It cannot be otherwise for *accuracy in representational drawing is based on relativities* and it is therefore logically impossible for an isolated line to be wrong.

The same argument would apply to the orientation of the line, if we were

not so accustomed to adhering to the convention of taking the top and side edges of the paper to be horizontal and vertical respectively. Thus," if the first angle is wrong by five degrees in relation to the verticals established by the edges of the paper and all the other angles are accurate in relations to it, the finished copy will map onto a similarly accurate drawing in which the first angle is correct in relation to the paper-edge verticals. Rotating either drawing by five degrees will bring the two of them into register.

Having demonstrated that the line in question is necessarily "*correct*" in length, I propose that it be used as the measure for the remainder of the drawing. This is why I refer to it as the *"benchmark line*". I can now introduce the rule that:

No matter what changes or corrections are to be made elsewhere, the length of the benchmark line is to be treated as sacrosanct

The choice of an inviolate measure is an important step. If all the lines are to be drawn accurately, the length and the position of the first of them will determine the *location* and the *scale* of everything in the drawing and, as a consequence, the *composition* as well. Sometimes students draw the line so long that the rest of the tree would not be able to fit onto the paper, sometimes they make it so short that the final drawing of the tree would be minuscule. In either of these cases, they are urged to reflect on these matters and redraw the *benchmark line* shorter or longer, as appropriate.

Drawing the second line

It is now time to tackle the second line, which I designate as the part of the tree contour between the bottom of the wall and the base of the tree (arrowed in *Figure 1*). The procedure requested of the students, which from now on is tightly controlled, is as follows:

- Compare the relative lengths of the part of the tree just drawn and the part about to be drawn.
- Redraw the line just drawn (in this case, the *benchmark line*), making sure that its end point is positively marked by applying a little extra pressure.
- Holding the pencil point still, look back at the tree and re-assess the relativities of the lengths in question.
- Draw the second line, using a smooth movement, once more marking

the end point by exerting a little extra pressure when you arrive at it.

For the time being, students are asked to follow this procedure blindly, just because I ask it. Later, the reasons for the required procedures will be explained.

The first attempt at a *length relativity* is now ready to be subjected to "*criticism"*. This word often seems to put people off. If it does, it is a great pity, for *without identifying mistakes, no learning can take place.*

In order to see inaccuracies students are asked to *look back and forth* between the stretches of tree contour being considered and the representation of them they have just attempted, with a view to *comparing* relativities of length. However, before allowing them to do so, two seemingly paradoxical points relating to self-confidence are made. The first concerns false confidence and the second relates to self deprecation.

- There is a great deal of evidence to suggest that unjustified confidence is rampant amongst members of the human race. One place it comes from is the high proportion of visually guided actions that occur without any looking back to determine their consequences. This is certainly true with respect to drawing-from-observation. According to my video tape records and years of personal observations, artists in general do very little checking back on the accuracy of lines just produced. Somewhat paradoxically, this is particularly true of rank beginners, with a low opinion of their own drawing skills.
- People who do check back may well have to face up to what they might see as the humiliation being made aware of multiple mistakes. Remember that errors of up to 20% and 5° can be expected[3] and comparison will routinely expose them for what they are.

If the students do see that something is wrong (particularly if the error is large) the question of confidence in ability has to be faced. Making a big error in the context of such a seemingly simple task might lead anyone who is unfortunate enough to believe in the adage that *artists are born not made* to infer that heredity is against them. There are two natural reactions to this too often drawn conclusion. The more devastating of them is to conclude that all is hopeless and give up the unequal struggle. I have heard far too many people, who are perfectly well equipped with the capacities required for learning to draw, make statements along the lines of, "*I would love to be able to draw but I could not do it to save*

3 See Vol. Chapter 5.

my life", and it can be very difficult to argue them out of this conviction.

The second natural and slightly less radical reaction to the making of large errors is to shrug the shoulders and argue to oneself, "*Well, as I have just provided positive proof that I am not blessed with special eyes and, since I desperately want to go on drawing, my only resource is to make the best of a bad job and find ways of hiding my deficiency*." For those who choose this braver line, help is available. There is an abundance of *How-To-Draw* books that are full of tricks tailor-made for this situation and the frustrated artist can be forgiven for making a beeline in their direction. Unfortunately, as explained in earlier chapters, using them can be a mixed blessing. The problem is that, although the practices suggested are likely to work *up to a point*, adopting them turns the false adage into a self-fulfilling prophesy: Their limited success obscures the truth that there is no need for them.

There is also a less natural but far more healthy reaction to the perception of the error. It amounts to something along the lines of, "*Hurrah, making the comparison has caused me to be aware of my mistake and put me in a position to learn from it.*" This reaction has the advantage of representing the true state of affairs and it is the only one which will lead to constructive learning.

A much more reliable adage than the one about artists being born not made is the one that says that, *"We only learn from our mistakes"*.

But, how can we learn from something if we are not first made aware of it? And, how can we be made aware unless we check back on what we have done? These are clearly rhetorical questions.

To sum up, we can say that learning from the lines that we have drawn requires three conditions:

- *Making mistakes.*
- *Being made aware of them.*
- *Making use of the new awareness that they force on us.*

The first comparison

Forewarned by all these considerations, the students are asked to go ahead with the comparison between a relationship in the scene (two stretches of tree trunk contour) and one in the emerging drawing (two lines). As just indicated, this is likely to draw attention to an error, though by no means always so. Perhaps

surprisingly often students declare themselves happy with the result. Sometimes, this is because the error is negligible. At others, another explanation has to be found. Usually it will turn out that the act of comparison has not been conducted in an appropriate way. In either case, it is necessary for me as their teacher to wait patiently for more evident errors to emerge, *as they surely will*.

Same/different judgements

At this point, I am likely to pause for some reflections on the subject of *comparison* and the *same/different judgements* that it entails. It is hard to exaggerate their importance, not only in drawing-from-observation, but in all aspects of visual processing, for they are integral to the way that the eye/brain learns at all levels of description. For example, same/difference judgements are necessary for revealing information at the micro-level, where groups of neurons compare inputs as a means of providing measures of *similarity* and *difference*. It is also necessary for the operation of more complex visual-systems, such as those used in *depth, motion* and *colour perception*. All of these use the same principle. They compare a number (two or a sequence) of light-stimulated patterns on the retina and generate information from *same/difference information*. Finally, comparison underpins more consciously accessible tasks involving an analytic looking stage, one of which is the correction of mistakes in drawings.

Back to the second line

It is now time to return to the second line and to yet more considerations that need to be kept in mind when eventually drawing it. We have so far got to the point where the student has noticed something wrong with the relativities between it and the first line drawn and was ready to make a correction. Since it has been stipulated that the *benchmark line* is to be the immutable standard for all subsequent judgements, this cannot not be changed. Thus, two simple questions need to be answered:

- Is the second line too long or too short?
- By how much?

Before going any further, it is important to emphasise that in the case of the comparison between this particular pair of lines, as in the case of comparisons between all other pairs of lines, *there will be no precise answer,* unless it is that they are equal. Same/different judgements are not like that. Whether relating to

line length or angle (or any other relativities) *comparisons* can only provide a *sense of the direction and amplitude of a perceived difference*. Their outcome can only be classified in terms of *relativities* such as *longer* or *shorter*, *more open* or *more closed* (or, where colour is concerned, *brighter* or *darker, greener* or *bluer*, *more textured* or *less textured*, etc.). It is counterproductive to look, as many do, for an answer in terms of fractions. Not only are these almost bound to be rounded off in one direction or the other and, consequently, to be inaccurate, but also the process involved in thinking in terms of fractions gets in the way of the *getting-a-feel-for-it* process*,* which we are trying to develop.[4]

Having got a sense of the nature and extent of the change that needs to be made to the second line, students are asked to repeat from scratch the entirety of the tightly controlled procedure they have just gone through. Thus the first line must be redrawn (on top of the existing one), the relative lengths of the two parts of the contour of the tree-trunk to be depicted must be reassessed and, only then, another attempt at the second line can be made. The purpose of going through each of these stages a second time relates to one of the main objectives of the lesson, namely the *training of the feel-system*. To sum up, the procedure involves:

- Getting a *feeling with the eyes* for the relationship between the first and the second section of tree trunk contour in the model as compared with the *feeling with the eyes* when making the same comparison in the copy.[5]
- Learning from the feedback produced by this comparison, which will indicate whether the two are either the *same* ("*right*") or *different* ("*wrong*") and by how much.
- Making corrections accordingly and, when doing so, making sure to *re-feel the second line* as being the necessary amount longer or shorter (whichever the case may be).
- Repeating this process until the appropriate eye/hand coordination needed to bring about a satisfactory result has been achieved.

From now on, all judgements will have to be checked, using comparison, and all lines redrawn and redrawn, again and again and again (as often as necessary), until they are perceived as being correct[6] and, equally or more important,

4 See *"What Scientists can Learn from Artists", Chapter 2,* for an introduction to the pervasive importance of feeling in brain function.

5 More on "*feeling with the eyes*" in *"What Scientists can Learn from Artists", Chapter 2.*

6 This rigorous repeated checking back is a feature that my drawing lesson shares with the teaching of Lecoq de Boisbaudran. It can be hard at first but will very quickly pays dividends.

until the feel-system has had the vital experience of doing the right thing.

The organisation of actions

Every action involved in drawing a line has to be organised in advance. The brain must give instructions to the muscle systems and, once they have done so, these are *carried out blindly*. Most people hesitate along the way. If we do, it means that the brain has broken up the action instructions into more than one movement (sometimes a large number of them). Even when people feel that they are drawing with more decision, they are unlikely to succeed in going from one end to the other without hesitation. The greatest skill is demonstrated by someone who can arrive in the right place in one smooth gesture (the equivalent of landing the pencil sharpener in my hands without my having to move them). With a little practice it is surprising what progress can be made in developing an ability to do this.

To help the process of smooth line production, I suggest that students make every effort to:.

- Start by marking the beginning of each line with a very gentle pressure
- Re establish the feeling for the distance to the other end of the line.
- Give priority to arriving at the end point, which should also be emphasised by means of a gentle pressure.

As their skill develops, the need to think about this marking end points with extra pressure will diminish and disappear. Only the smoothness and decisiveness of line production will remain.

A quick look ahead

The eventual outcome of this rigorous preliminary training will be that the feel-system can take over the bulk of the work, enabling the output of lines to become seemingly continuous. When this happens, analytic glances will take but a fraction of a second and will mostly be made without reference to the emerging depiction (often, taking place during line production). Indeed, all the advantages of *CLAM* drawing[7] will be available to the students, with the big difference that *they will be much more in control of the situation than when they have developed their skill by any method which fails to give priority to the role of feedback at the learning stage.*

7 Explained in *Chapter 5*

Memory for spatial layout

Having broken the ice with the production of the first two lines, the lesson continues with bouts of drawing, interspersed with a drip feed of information. As before, the tactic is to explain the reasoning behind everything that the student is asked to do and, thus to build up, bit by bit, a coherent and comprehensive framework of relevant knowledge. It is a slow process, but the pace does accelerate. Indeed, there are good theoretical reasons for pushing it along a little. One of them, as just explained, is that control over ballistic movements will never be achieved by those who dither. Another concerns the feel-system's memory for spatial layout.

Imagine that you are in a room illuminated by artificial light that has two doors with a table in the direct line between them. Imagine that you are standing by one of the doors and looking across the table to the doorknob on the other. If you now switch off the light, you will find that, despite the darkness, as long as you do not hesitate too much, you be able to circumnavigate the table and arrive at the door knob on the other side of the room. The reason that you are able to do this is that in the process of looking across the room, you have created a memory for the relevant s*patial layout*. However, if you hesitate, this *feel-system memory* will fade. According to one set of experiments, you have just 8 seconds to cross the room. Analogously, when we look at the layout of a scene that we plan to drawing, we create a memory for guiding the drawing instrument. In this situation also there is a limit to the relevant feel-system memory. This is another reason why students are encouraged to press on in a business-like way, with as little hesitation as possible. The only risk is making more mistakes which, of course, is no bad thing, since it means creating more learning opportunities.

The first angle

Having been urged in the direction of decisiveness, it is now time for the students to broach the first angle. The one often selected is that between the side of the tree and the top edge of the wall (indicated by an arrow in *Figure 2*). The procedure is the same as before. Thus:

- The angle must be assessed.
- The pencil must be placed at the start of the previously drawn line (that is to say, the one describing the part of the edge of tree trunk situated between the wall top and wall bottom).

- A line has to be redrawn *up* towards the junction between the wall-line and the tree-line (The reason for making this upward movement is to *feel* the direction of the line).
- Before starting along the wall top line, the students are reminded that, when they reach the junction-point, they must stop and make a firm, if gentle, mark and, holding the pencil still, reassess the angle to be drawn.
- Finally, they are asked to make a stab at drawing the remainder of the angle.

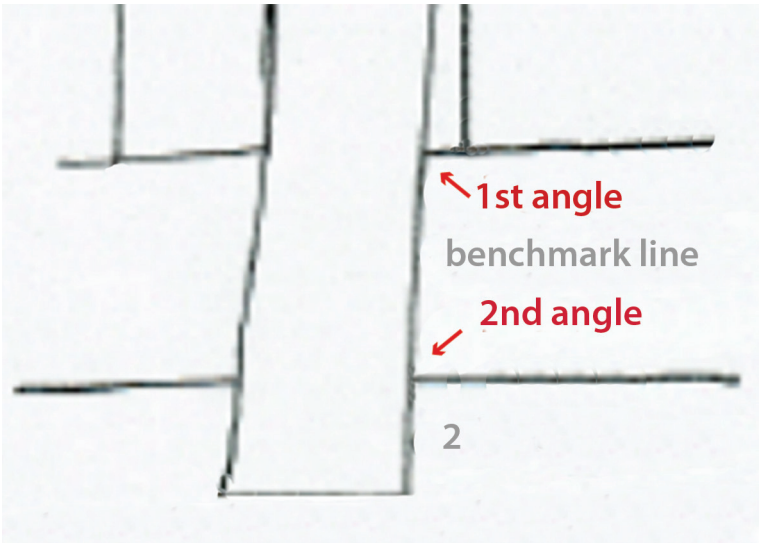

Figure 2 : The first and second angle

When they have completed their task and *before* they have time to look back at the result, the students are reminded once more that the average error in my experiments was 5 degrees and that errors 10 or 15 degrees were common. This is to reassure them in advance should they be about to detect a large error. In the highly likely event that they do, they should not be discouraged but be ready to have another go. As with the relative-length judgements, any changes must be made by repeating the whole procedure of:

- Making the analysis of angle (made easier by the fact of having made the mistake).
- Redrawing the contour of the tree up to the point where it intersects with

the line defining the top edge of the wall.

- Stopping to make yet another assessment of the angle before redrawing the wall-top.
- Checking out the result.

Students are asked to repeat this process until completely satisfied. At this crucial stage, the combination of *rigour* and, if necessary, *perseverance* is essential.

Line drawing direction

Research has shown that people find it more natural to draw lines in some directions than in others and that this *directional preference* can get in the way of good drawing practice. Producing an angle in the way just described has a determining effect on the direction in which the line is drawn. Very often, this will mean that at least one of the two lines will have to be drawn against the natural preference. The problem is that if you always draw lines in the direction with which you feel the most comfortable, it will frequently mean that you lift the pencil off the paper and, thereby, break the continuity of line production. At least three important negative consequences follow:

- The short-term visual-memory required for making comparisons is disrupted each time it is necessary to relocate ends of lines that have already been drawn. Consequently *the relativities being kept in mind are lost*.
- Repeated acts of relocation *interfere with the flow of line production* and, therefore, the speed and/or directness of drawing actions.
- The *training of the feel-system* is impeded because the opportunities for getting a feel for either the angles or the relativities of line lengths being drawn are significantly reduced.

For all these four reasons,

It is important to resist allowing stroke-direction preferences to dominate drawing practice.

One way of achieving this objective is to stick firmly to the method of line-production recommended for the lesson described in this chapter. The instructions which you are asked to follow determine where every line must start and, consequently, also the direction in which lines will be drawn. At first, this may cause some awkwardness. However, anyone who follows the method will find that this will diminish rapidly and, before long, fall away entirely.

The next three lines

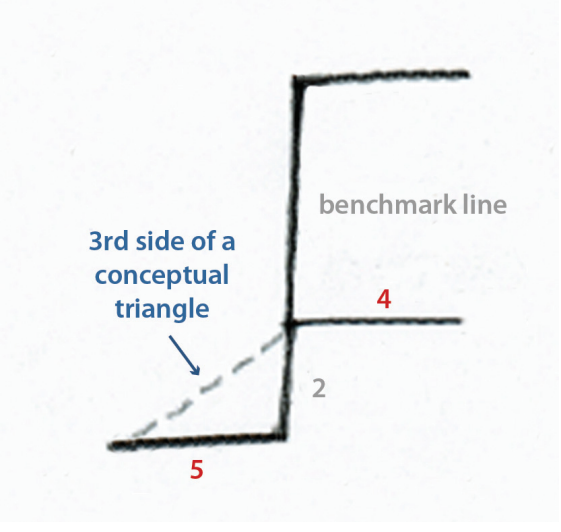

Figure 3 : Lines 3 to 5

Figure 3 is a diagram of the lines which follow. The act of drawing the first angle has already supplied the wall-top line (line 3 in the diagram). Next comes the wall-base line (line 4 in the diagram). As with line 3, line 4 requires an assessment of an angle and should be drawn in relation to the *benchmark line* to produce the second angle indicated in *Figure 2*. The same procedure as before must be repeated:

- Make a careful preliminary assessment of the size of the angle in question.
- Redraw the *benchmark line* down to the junction of the two lines that make the relevant angle.
- Gently mark the end point.
- Visually *reassess* the angle, while holding the point of the pencil still,
- Embark upon the angle-making second line, with as much decision as possible (for the time being, since it is only the angle that is in question, it only has do be long enough to establish its direction).
- Check the result by making the appropriate comparisons.

As before, the need to re-draw the *benchmark line* is because, without doing

so, the feel-system will not experience the *sensation of drawing the angle*, and checking back on what you have just done is the only way to get the *feedback* upon which learning depends. Any perceived error should be corrected immediately and *all corrections should be made by going through the whole procedure from the beginning.*

The tree-base line and triangulation

The fifth line to be drawn is the base line of the tree, where its trunk disappears into the ground (line 5, in *Figure 3*). This has to be related to the second line drawn (line 2, in *Figures 1,2 and 3*). The process forces the students into drawing *both an angle and a relative length* simultaneously. It also entails the added complication of making a comparison between a vertical line and a horizontal one. This should be done, first, by *feeling with the eyes* and, then, by *sensing with the body-arm-hand-line output system*. As the procedure is more complex, it will not be surprising if it turns out to be more difficult. If this is the case, a way of easing matters is to turn to the time-honoured device of *triangulation*, a procedure which entails *imagining* a line joining the left-hand end of the tree-base line (line 5) with the junction between the vertical tree contour and the bottom edge of the right-hand wall (the meeting point between line 4 and line 2). This creates an imaginary triangle which can usefully be compared with the equivalent triangle in the drawing (indicated by the dotted line which joins lines 2 and 5).

Closing a shape

A triangle made in this way is an example of a "*closed shape*". These occur whenever the *free ends of the first and last lines of a sequence* are joined. The triangle is particularly helpful because of its simplicity. *Figure 7* provides a more complex example that will be recognised from the earlier chapter on "*negative shapes*".[8]

The process of *closing a shape* inevitably produces a *useful simplification* of what otherwise would have become a progressively complex set of relationships. Thus, for example, far from complicating matters, the addition of the final line of an irregular quadrilateral constitutes a great simplification. It transforms *a collection of three lines of different lengths and orientations*, each of which has been assessed by a fallible visual measurement system and implemented by a fallible

8 *Chapter 4.* Notice that the "*negative shapes*" discussed in that chapter are always also examples of "*enclosed shapes*".

output system, into *one shape*. As such it can be compared *as a whole* with its model with the result that drawing errors which went unnoticed when producing the individual lines will be brought to attention automatically. The usefulness of this kind of simplification varies with circumstances but it can be particularly important if the shape being completed is made up, not of straight lines but of *complex curves*, as is actually the case both with the "*triangle*" imagined for triangulation purposes (*Figure 4*),[9] and with the shaded irregular "*rectangle*" in *Figure 7*.

Despite the help of triangulation, mistakes can still be made with respect to the relationship between the section of the side of the tree below the wall-bottom (line 2, in *Figure 3*) and its bottom edge (line 5, in *Figure 3*). For this reason, it must be double-checked. The students are asked to continue checking until they are completely happy. If ever, after completing a new attempt at getting the tree base-line right, they still see a mistake, they are asked to go through the whole procedure described above of re-drawing and re-feeling the comparator line before attempting to feel both the angle and length of the new line.

As already admitted, all this repetition can prove to be a tedious business. However, if persevered with rigour, *practice will increase efficiency and the whole process will get easier and easier.* On the other hand, if matters are let slip at this stage, practice will not provide any true benefit, no matter how much of it.

A little trick and its fruits

When the students are happy with the baseline, the next task is to get up the other side of the tree. This provides an opportunity for increasing the pressure in three ways, namely by:

- Including more features in a sequence.
- Encouraging students to press on a little faster.
- Introducing a little trick into the procedure.

Accordingly, instead of dealing with one new line at a time, the next task is to draw four of them in rapid succession. These are illustrated in *Figure 4*. They are:

- The line representing the as-yet-not-drawn, left-hand side of the tree, up from the left hand side of the base-line to the bottom of the wall (line 6).
- The line representing the bottom of the wall (line 7). This is just to establish its angle, which can be done by going out along it a short way and

9 Since even the straightest of the contours of the tree trunk is not actually straight.

then back, without taking the pencil off the paper.

- The line representing the continuation of the side of the tree, as far as the top of the wall (line 8).
- The start of the line representing the top of the wall (line 9). Since this, like line 7, is just to establish its position and its angle, its length is not important.

In total, three angles and two relative length have to be produced.

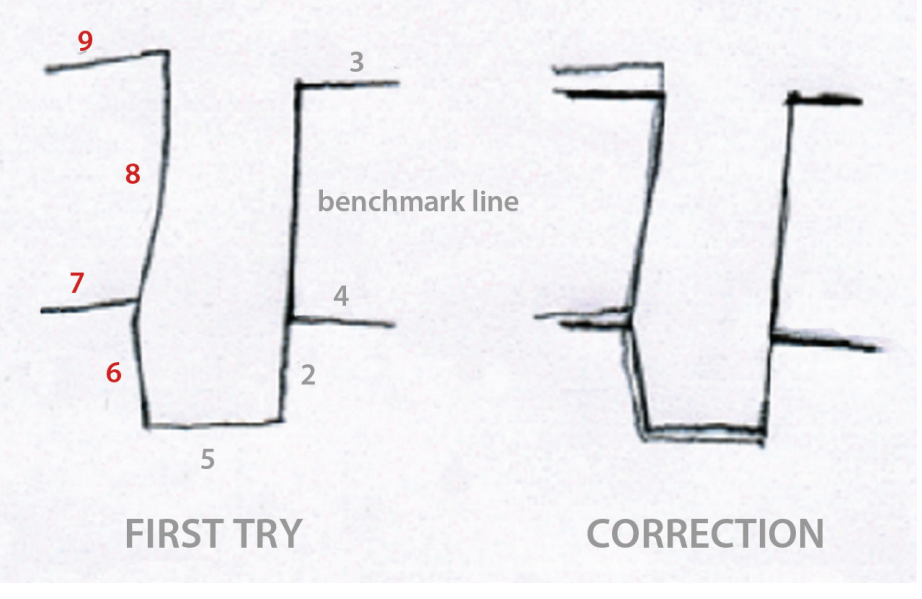

Figure 4 : Lines 5 to 9

The "*little trick*" is for me to cover up the first four lines drawn (lines 1 – 4), leaving only the tree-base line (line 5) in view. This being the only visible reference available, it takes over the role of the *temporary benchmark line*.

Students tend to be aghast at the idea of being deprived of so many reference points. However, with any luck, when their task has been completed and the rest of the drawing has been uncovered, the little trick will have produced its fruit in the form of a number of very clearly noticeable discrepancies between the proportions just drawn and those of the hidden side of the tree. In particular, the wall-bottom lines (3 and 4) and the wall-top lines (7 and 9) on the two sides of the tree may well be seen to be woefully out of alignment.

Why should this seeming setback be described as lucky? Surely, the best result would be the correct alignment of the two parts of the wall hidden by the tree trunk. Though, in the long run, this might be true, in the short run, it would *deprive the students of a precious learning opportunity*. Consider what might have happened if the covered up parts of the drawing had been left visible. The students would almost certainly have fallen for the temptation of adopting the widely-used strategy of aligning the wall-bottom and wall-top lines on the left hand side of the tree with the already existing ones on the right hand side of it (that is to say, align line 9 with line 3 and line 7 with line 4). As the use of this strategy would have resulted in the tree-wall relationship being credible, a false sense of security would have be engendered. Many years of experience tell me that one outcome would be to overlook the need to check back on the length of the tree-base line (line 5), possibly with disastrous consequences in terms of the tree trunk width. After all this line was the fruit of the most difficult line-length judgement up to now.

In contrast, if the wall-lines on the two sides of the tree proved to be out of alignment a significant advantage would ensue for every measure so far made would be thrown into question. *This is a highly desirable outcome* because, as a general principle, *having questions to ask is the most effective means of bringing knowledge-driven, analytic systems to our aid.* We should never forget that without their help, we would be impotent.

At this stage, students are reminded that the aim of the drawing lesson is not primarily to produce an accurate drawing of the tree (although it will do so). Its purpose is to provide tools that will help them to undertake their own personal voyage of discovery. Tricking people into making obvious errors, despite trying their best, is a way of furthering this objective. It faces them up to the reality of their *poor capacities* for making the required judgements and helps them reflect on their predicament. It is my job to assist them to accept not only their limitations (which they share with everyone else) but also the evidence presented earlier that with appropriate practice *everyone can learn to use their flawed visual-measuring apparatus to produce accurate drawings from observation.*

For these reasons, the moment when the other side of the tree is unveiled, the students are faced with a *moment of opportunity*. Although their first reaction to the undeniable evidence of the extent of their errors (which can be quite spectacular) may well be to feel that all the efforts made so far have been wasted, for the reasons just explained, this is not at all my response. No matter how blatant

the inaccuracy revealed, I regard it as yet another demonstration of someone with normal but untrained capacities doing what can be expected of them in the circumstances. Rather than being discouraged, I am feeling optimistic. Based on years of experience of analogous situations, I know that, from now on, if only I can encourage the students over this particular *Rubicon*, there is a high probability of rapid progress being made thereafter.

If the wall lines turn out to be perfectly aligned, I have to wait another opportunity to make the same points. It will surely come.

After offering reassurance along these lines, the next step is to set our minds to working out what is wrong. There are several possibilities, each of which generates questions that in all probability have not been asked before. I suggest four alternative explanations for the failure to match up the wall-edge lines on the different sides of the tree. The first three assume that the students have done well in relation to the base-line of the tree, but not to earlier measures. They are that:

- The two approximately vertical lines on the left hand side of the copy (lines 6 and 8) are correct both in proportion to one another and to the approximately horizontal tree-base line (5), but the latter is wrong in proportion to the vertical lines that preceded it (lines 1 and 2). As already emphasised the tree-base line is particularly difficult to estimate. Here it is worth noting that a likely reason for not trusting earlier proportions is that the assessment of the relative length of the right hand vertical (lines 1 and 2) was the first relative-judgement of its kind to be made. For this reason alone, it is especially prone to error. As with all errors this will have a knock-on effect in relation to the length of the tree-base line (5). If the result is that this has been drawn too short, the wall on the left hand side would come out as being too low and, if too long, as too high.
- The proportional relation of the three lines are correct but the angle between the right hand side of the tree (line 2) and its base (line 5) is wrong. If too acute, the result would be to push up the height of the left hand wall, if obtuse, to push it down.
- The angles at which the top wall line (line 3) and bottom wall line (line 4) on the right hand side cut the tree contour line (line 1) are wrong, with the result that their imaginary continuation behind the tree arrives in the wrong place.
- The line from the bottom of the tree to the bottom of the wall (line 6)

and the line from the bottom of the wall to its top (line 8) are not in the correct proportion to one another.

In practice we can suspect that the explanation is very likely to involve an amalgam of more than one of these factors. Most students seem to jump to the last conclusion first. This is as natural as it is a pity. A little thought should convince them that it is no more likely to be the cause of the problem than any of the other relativities. However, whatever the reason for their mistakes, the students have a puzzle to solve which is not yet so complicated as to defy solution.

Gaging the width of the tree-trunk base

Experience shows that, in practice the most likely error concerns the width of the tree trunk (that is to say the length of line 5). The main explanation for this lies partly in the fact that the task of drawing the base-line according to the instructions given requires an estimation of the relative lengths of two edges that have significantly different orientations. A further reason for the likelihood of greater error is that the task of making the estimation is complicated by the additional factor of having to make an angle estimation.

A first approach to correcting this is simply to ask whether it looks right. Another one is to focus the question a little more and ask whether, looked at as a whole, the tree trunk seems to be too wide or too narrow. This simple device can be very effective because looking at it in this way is analogous to closing a shape in the sense that it reduces the complexity of the comparison.

If this does not work, an often helpful strategy is to draw lines on the copy such that they illustrate what the tree trunk would look like if the base had been made either broader or narrower. This provides a set of different possible tree widths and different imaginary triangles (of the kind illustrated in *Figure 3*) with which to compare the same features of real tree trunk. By providing a set of straightforward same/different judgements, this tactic can often solve the problem. Suddenly, the error and its direction become evident.

The tree-trunk base angle

The second most likely mistake concerns the angles at which the right hand side wall lines cut the tree trunk relative both to each other and to the angle of the base of the tree. If the students have already had the lesson on perspective

described later[10] the solution of the faulty angle problems could be approached by reference to it. If they do not yet enjoy this advantage, they are referred to a device which is one of the many ways of establishing a relatively reliable reference horizontal. This depends on two phenomena.

- In the same way that a sphere retains its shape from all angles, the bases of cylinders remain constant when they are rotated.
- The base of a cylinder at or near the eye-line is either flat or nearly so.

From this it follows that, other things being equal, *the base lines of trees are likely to be fairly horizontal*.[11] If other things are not equal (for example if the tree is on a slope or has an irregular growth of grass in front of its base, as is the case of the tree in question), it is usually easy to see why, and to compensate accordingly.

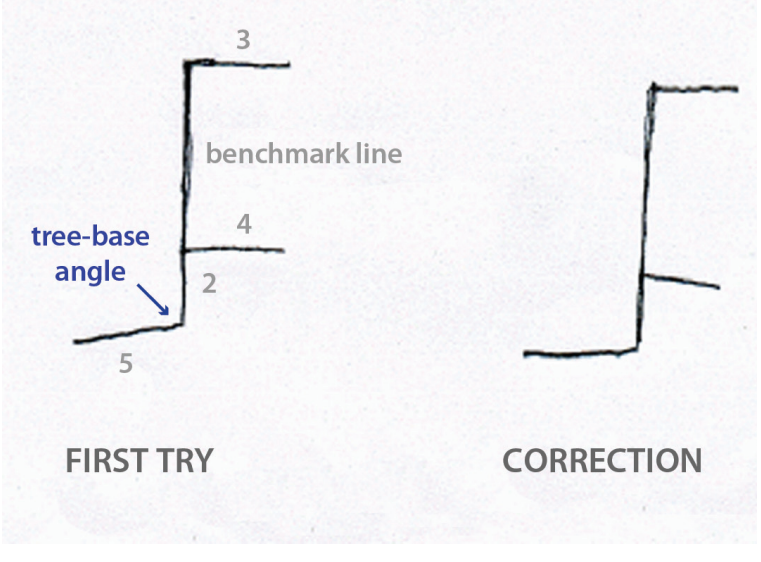

Figure 5 : Tree-base angle

With the help of the cylinder idea, it is usually possible to get students to see if the orientation of the tree-base in their copy is sloping more or less than the actual tree-base. Experience shows that it frequently is. The explanation for this strong tendency often turns out to derive from an earlier mistake. Very often, the wall-base line has been drawn too horizontal. There are a number of possible reasons for this, which will be discussed later in the book in this series on linear

10 *Book 2,* in this series.

11 Except if viewed from close-up

perspective However if students start with the tree-base (line 5), which they are now seeing as horizontal, and relate it to the wall base (line 4), they will very likely see the angle of the wall-base in a new light and be able to make a correction along the lines illustrated in *Figure 5*. In this the tree-base line is much nearer to horizontal and the wall-base line is sloping down from left to right, away from the tree. Notice that the angle between line 4 and line 2 remains constant and that the relative orientations of the top and bottom of the wall are now consistent with the laws of linear perspective, which say that nearer parts of any rectangle are seen as larger.

By this point in the lesson, students might be wondering why their teacher is so determinedly niggling away at every little detail. The answer is that both theory and experience show that *retraining a habit-guided system is never an easy matter*. There is a real battle to be waged and the quickest way to victory requires a slow and careful start. This is true both of individual drawings and of the longer term objective of this lesson which, as frequently reiterated is to enable people to learn to draw *fast, accurately* and *with feeling*. It is also important to realise that *every accurately produced line provides a reference that can be trusted.*

As these trustworthy elements accumulate, the task in hand becomes commensurately easier. In contrast, if the early relativities are incorrect, their presence can only confuse the situation, with the result that accuracy will be more and more difficult to achieve.

The pace hots up: the next five lines

However, from now on things usually speed up enormously. With all my talk and with all the corrections, the first nine lines may have taken two or more hours to produce. In contrast the following nine may only take twenty minutes or so. The first five of these are illustrated in *Figure 6*. Taken together they create an enclosed shape (the shaded area), which when completed will considerably help accurate analysis.

Whether going for the whole enclosed shape or not, this section of the drawing lesson offers the opportunity to remind students that *it is easier to make relative line-length judgements if the lines being compared are similar in length.*[12]

This being the case, the fact that the distance from the wall top to the eaves is more than twice the height of the wall will pose a problem. Drawing it in one movement in relation to the *benchmark line*, will entail the risk of making large

12 As explained earlier and in the *"What Scientists can Learn from Artists", Chapter 5.*

errors. Accordingly, it is sensible to find a *staging post*, so that the line can be drawn in two nearer to equal length lines.[13] An obvious marker would be the small protruding stump and I suggest that the students use this.

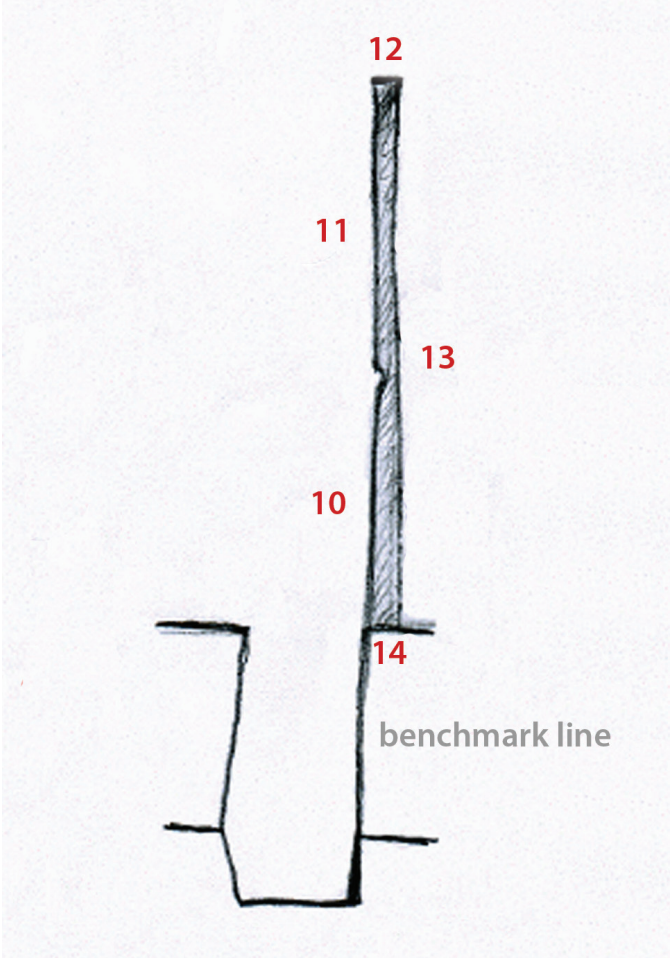

Figure 6 : Lines 10 – 14

However, before asking them to do so, I point out that the existence of such a convenient marker is a lucky chance. If it had not been there, I would have advised them to look for a mark on the wall of the house providing an in front/ behind relationship. For example, they might have used a horizontal division

13 If the length of the line between wall top and eaves had been longer, it might have been appropriate to divide it into three or more divisions, as appropriate.

between two of the rectangular wall stones that visually-speaking cuts into the tree trunk. The advantages of using in front/behind relationships are such that I am tempted to ask the students to use this in any case. But it would not be a good idea in this case since, if another marker were to be used, the existence of the stump would provide a distracting element, capable of disrupting the relative length judgements in question.

The procedure to follow for getting up to the bottom of the eaves is essentially as before:

- Get a sense of the three relativities to be drawn. Take plenty of time doing this.
- Redraw the *benchmark line*, so as to reestablish a feel for its length. Remember it is the feel of the distance covered that matters. For this reason, as long as the beginning and the end of the line are firmly marked, *the pencil need hardly touch the paper in between*.
- With the pencil poised on the paper, reassess the relativities of wall height and distance to the stump-level marker. This only needs one glance.[14]
- Draw the line up to and including the small protruding stump. It should be produced as decisively as possible and the end point should be positively marked with a small increase in pressure. This will happen naturally if it is regarded as a target to be reached.
- Keeping the pencil firmly poised on the endpoint of the line just drawn, refresh the estimates for the second relativity (that is to say between lines 10 and 11). Again this only needs a glance.
- Power on to complete the tree-contour line from the small protruding stump up to the eaves (line 11). Again, think of the endpoint as a target and mark it positively with a small increase in pressure.

If progress up to this point in the lesson has been *good*, the fourth step, namely that of starting out along the eaves, can be added to the last sequence. If so, students would have been asked to prepare themselves in advance, at the beginning of the sequence by estimating the angle involved. They will also have been reminded to pause at the top of the tree-eaves junction to refresh their memory at a glance, before drawing the angle between it and the eaves.

If progress has been really *excellent*, students may be encouraged to com-

14 *Vol.1, Chapter 5*

plete the whole enclosed shape in one sequence. In which case, proceeding on the same lines as before, when making the preliminary assessment of all the relativities of length and angle, they will have been asked to add the length-of-the-eaves line, the descent down the house-contour line and the return to the point of departure along the wall-top line. More normally, these last stages are accomplished separately.

The first enclosed shape

On completing the first enclosed space (shaded area in *Figure 6*), it is important to take the opportunity to ram home the lesson already introduced in the context of triangulation. Thus, the attention of students is called to the completed shape in their copy and they are asked to compare it with the corresponding shape in the model. It is emphasised that this comparison is like the one between the two mugs in the experiment with children, mentioned earlier. Any important differences are likely to draw themselves to the attention automatically. Once again, the student is both warned not to be discouraged if the errors seem large and encouraged to take advantage of them by analysing their causes. The analytic activity will greatly help the attempt to redraw the lines that make up the enclosed shape in question and this is the next thing that must be done. Once more, rigour is crucial.

While assessing the enclosed shape, another strategy can be extremely helpful. This is moving the head from side to side so that the gap between the tree trunk and the house corner is made to vary. This procedure makes use of the *motion-based comparisons* to bring useful information *automatically* to attention. It is one of the most powerful *awareness-raising tools* available to us. However, it can only be used if the first step in the drawing lesson has been followed and the original relationship between the tree and the house has been marked by easily-referred-to in front/behind relations.

The last four lines

Now it is time to draw the left-hand side of the tree from the wall-top to the eaves. Once again, the opportunity is taken to encourage errors by covering the right hand side of the tree. As before, the procedure is likely to make it easy for students to recognise discrepancies between the two sides. Thus, if we compare the left hand side image in *Figure 7*, labelled, "*1st try*" with the right hand side one, labelled, "*Correction*" we will easily see various ways in which they differ.

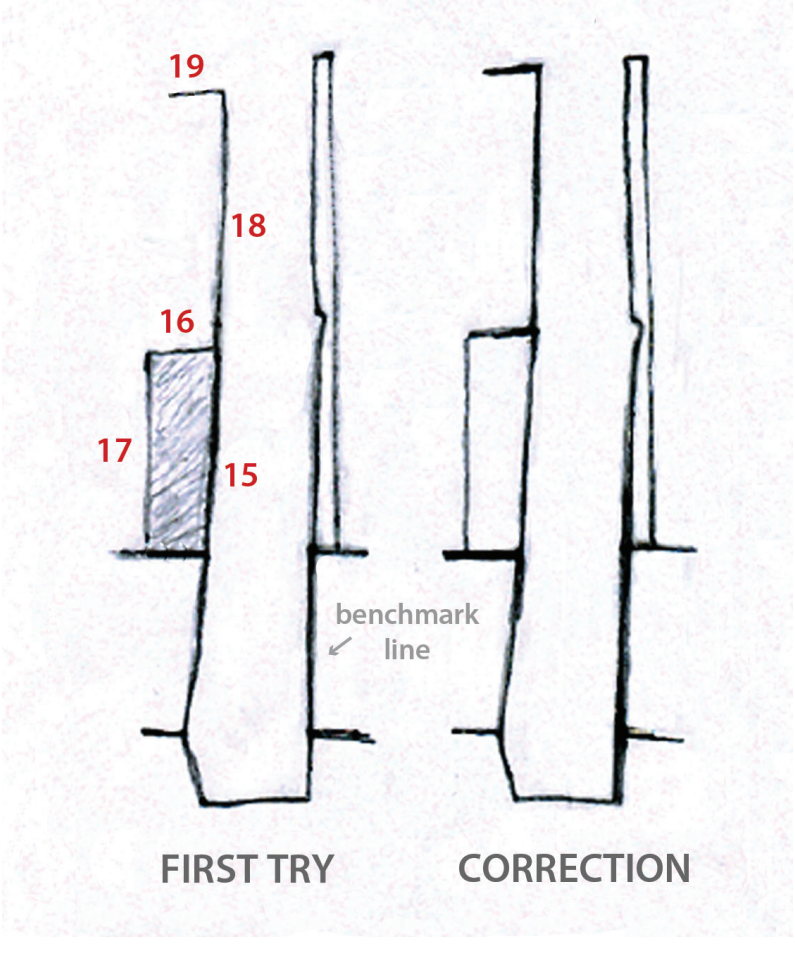

Figure 7 : Lines 15 - 19

If we assume that the "*correction*" is more or less accurate, we find that relatively speaking:

- The window-top line (16) will be seen to be too low, relative to the bump on the right hand side of the tree.
- The eaves-line (19) is much lower on the left hand side of the tree than on the right hand side.

Since there is no particular reason why the earlier judgements (relating to lines 10 & 11) should be better than the current ones (relating to lines 15 & 18), students are faced with the unavoidable conclusion that all previous measurements

will have to be reviewed. Once again, the knowledge that despite all their best efforts mistakes must have been made, means that everything (except of course the *benchmark line*) must be looked at with new level of attention and awareness.

Fortunately, all the analytical work the students have been doing will almost certainly be beginning to bear its fruits by this time. By some *mysterious process*, they will find themselves better equipped for the process of criticism upon which they must embark. Accordingly, it is almost certain that they will see errors where they could not see them before and that any new corrections will result in the whole copy becoming much more accurate (for example, as in *Figure 7*, "*correction*").

As just suggested the most important part of the explanation for the improvement will relate to the accumulating evidence that the process of learning to look in new ways is getting on nicely. However, an additional reason may be that the students are loosing inhibitions relating to performing in front of a teacher.

The drawing lesson in retrospect

After possibly three hours of concentrated work, the practical part of the introductory lesson is now over. Looking at it in the perspective of hindsight, certain points can be emphasised.

It will be surprising if students have not made progress with respect to the smoothness of line-production. Most of the early wobble will have gone, as will much of the awkwardness of starting in unfamiliar directions. Very soon, as the motor-control system gets the hang of what is required of it, line production skills become second nature.[15]

At some point it will be necessary to encourage students to dispense with the line-covering trick and trust themselves to ignore the temptation of aligning the two opposite sides of the tree (or any other figure) in the hope that doing so will stimulate awareness-enhancing errors. If no errors are forthcoming, the procedure will not have failed, since it will provide encouraging evidence of enhanced capacities for making accurate drawings.

As already indicated, one advantage of having got off to a rigorous start is that, as the drawing emerges, a*n accumulating number of reliable reference points can be used for cross-checking every new line or angle.* Accordingly, the whole process is made progressively easier.

15 As with learning to ride a bicycle or learning to type.

If the necessary time and trouble have not been taken and the first attempts at reproducing the relativities are inaccurate, the opposite is the case with the result that the process gets more and more difficult. It is like trying to fit a five-cornered carpet into a four-cornered room. Each correction shows up earlier errors and hours can be spent on what amounts to a hopeless task of trying to restore order. It cannot be too strongly emphasised that *the time taken in assuring early accuracy pays off handsomely in terms of the time necessary to produce the finished drawing*.

Finally, students will find themselves beginning to think on their own account. They will less often have to be reminded about procedural details and they will start working out what to do next for themselves. In general, as the drawing evolves, everything will be progressing much more smoothly and quickly, with much less interference from me.

However, the drawing lesson as just described is only the start of a process. The remaining chapters and the next books in the series suggest ways of taking it further.

Implications

The drawing lesson described in this chapter and the previous one is unique in many ways. In particular, it lies in the combination of:

- *The stress on training the ability to feel with the eyes and to coordinate this with other parts of feel-system capacities, in particular, those that mediate line output and emotional responses.*
- *Taking the mind off interfering object interpretations (no need for using the misleading concept of "negative shapes" to do this), while enabling it to attend to basic building blocks of visual perception.*[16]
- *Breaking up the scene into manageable chunks using in front/behind relations wherever they can help in doing so.*
- *Guarding size and angular relations not only within the object which is being drawn but also, and equally importantly, between the object and all aspects of its context.*
- *The focus on same/difference judgements as the only way of analysing relativities of length and of being made aware of differences between the model and the copy with respect to relative lengths and orientation.*

16 Sections of contour, angles at junctions and curvatures.

- *The role of mistakes in calling attention to unpredictable differences between model and copy and, in doing so, providing the opportunity to go beyond existing habits of looking and, thereby, use drawing-from-observation as a tool for seeing in new ways (extending knowledge of appearances).*
- *The provision of a scientific basis for every detail of the lesson. The explanations as to why everyone can have confidence in their seemingly severely limited capacities are more extensive and hopefully more convincing than will be found elsewhere. They should reassure any doubters that they have visual and line-output systems that will enable them to produce drawings of the highest level.*

However, having the resources at our disposal does not mean that attaining our objectives will be easy. Like all skills, drawing-from-observation has to be learnt and this means not only finding ways of by-passing existing habits but also of negotiating the minefield of perceptual illusions created by the way the eye-brain works. In principle, the method described in this chapter will cope with these. However, in practice, it can help a great deal to be forewarned of likely problems. For this reason I have written a second book on the subject of using knowledge of visual illusions, linear perspective and anatomy as guides to looking. Meanwhile, to conclude this book, there follows a chapter on how to follow up the drawing lesson just described, a process which includes extending it to include dealing with problems associated with the analysis of complex curves.