
CHAPTER 2

Knowledge, skill and feelings

Introductory

This chapter introduces readers to some fundamental discoveries made by artists concerning the roles of “knowledge” and “feeling” in their work. A major aim of the book as a whole is to show how these can be fitted into a scientific framework to the mutual benefit of artists and scientists.

KNOWLEDGE

Before going to art school in 1967, I spent four years working on my own as what is often termed a “*self-taught artist*”. What this really meant was that, besides long hours of drawing and painting both out of doors and in my studio-sitting room, I read lots of books and went to classes at weekends under the guidance of Marian Bohusz-Szyszko, a Polish artist and teacher of distinction. From him I learnt a great deal, including insights that had bearing on the subjects of colour, light, illusory pictorial space and pictorial harmony. All of these should be of profound interest to scientists and will play a large part in what follows.

With respect to drawing, my main source was Vernon Blake’s book, “*The Art and Craft of Drawing*”.¹ The lesson I found in it that struck me most forcibly related to a study by Edgar Degas (*Figure 1*) and the five pages of text which accompanied it. These latter contained an extremely detailed analysis from a strictly anatomical point of view that convincingly showed that pretty well every nuance of line and mark in the drawing can be related to precise information relating to bone and muscle structures. I was deeply impressed by what I felt to be incontrovertible evidence that a seemingly rough and ready drawing technique is compatible with the highest level of rigorous analysis. I was also made very aware indeed of the potential value of a deep knowledge of human anatomy.

1 “*The Art and Craft of Drawing*”, Vernon Blake, Dover 1927



Figure 1: Study of Nude woman by Edgar Degas

As the years went by, I became more and more convinced that the twin qualities of *deep knowledge* and *exacting standards* are exemplified in the drawings and paintings of all the artists whose work I most admire. Amongst these are not only old masters, like Leonardo da Vinci, Michelangelo and Rembrandt, but also many *Modernist* masters whose work some have described as slight and, even sloppy: “*A child could have done as well*” was to become a familiar refrain. In this category are Paul Cézanne, Vincent Van Gogh, Henri Toulouse-Lautrec, Pierre Bonnard, Henri Matisse, Pablo Picasso, Paul Klee, Jackson Pollock, Mark Rothko and many more. Without exception, all these artists imposed on themselves exacting constraints, which had to be met if a work was to be considered complete.

One guide to the importance of these self-imposed standards is the number of re-workings and sittings routinely necessary to finish a portrait. Records left to posterity by long suffering sitters provide many examples. Thus, Manet could exceed 40 sittings (one expert says 80)², often with several re-workings in each, Cézanne was known to go well beyond 100 sittings, Toulouse-Lautrec could surpass 70 sittings, Picasso took more than 80 sittings for his portrait of Gertrude Stein, Bonnard regularly spent months and sometimes years to bring a painting to completion, Munch worried at each of his major themes over many years, Mondrian once took a year of concentrated work to finish one of his black line *Constructivist* paintings, and the number of preparatory studies routinely produced by Matisse is simply mind-boggling. Some artists (notably Seurat, Kandinsky, Mondrian and Klee) felt that it is important to develop a theoretical framework within which to work. Others, including the rest of the artists listed above have relied on less tangible though none the less exacting criteria. In summary, the common factor that governed the working practice of these artists was self-imposed exacting standards.

By definition, standards have to be based on frameworks of ideas (however clear or vague these might have been). In practice, these have performed the double function, not only of motivating and inspiring *artistic activity* but also of providing the basis of *value judgements*. A main argument put forward in this book is that far from straitjacketing the artists, these self-imposed *conceptual constraints* gave them the *freedom* to express themselves in their various, characteristic and nowadays much appreciated ways. Indeed it will be argued that without the *constraint*, the word “*freedom*” in this context could have little or

2 Adrian Heath, personal communication.

no meaning. To explain why, we can turn to another lesson coming from Edgar Degas. It concerns the *limits of knowledge*.

The limits of knowledge

Degas is famous for his pertinent and mind-expanding aphorisms. It would be hard to exaggerate the significance for anyone who aspires to creativity in drawing or painting of the one which follows. It relates to Degas' attitude when making studies such as the one illustrated in *Figure 1*. What he said was: "*I must impress on myself that I know nothing at all, for it is the only way to make progress.*"

How can this be? Here is an artist of unsurpassed knowledge of human anatomy asserting the *necessity of ignorance* when setting about drawing the human figure from observation. How do we explain this paradox? About what did he know nothing?

The answer is not hard to find. Degas was in the same position as any other artist or person engaged in depicting a nude model (or any natural object). Nobody, no matter what their level of knowledge, can know anything about the particularities of any pose with which they are confronted. That this must always be the case can be deduced from five well-established facts:

- That every aspect of every person's appearance is unique, right down to the finger prints.
- That every *pose* taken up is unique even if often only marginally so.
- That each new *viewpoint* (whether due to changes in viewing angle or viewing distance), no matter how close it is to its predecessor, provides a new set of relationships between the different parts of the model's body.
- That every *lighting condition* is unique as a result of variations in the disposition, number and strength of primary and secondary light sources³ and their relation to the multiple facets and surfaces of the model's body.
- That every *context* is unique, since it comprises unique objects and surfaces in unique positions, looked at from unique viewpoints and under unique lighting conditions.

From these five truths it follows that the possibility of any two views of any as-

3 The name given to the light coming from any source that is less powerful than the primary source, including all reflecting surfaces (that is to say *all* surfaces).

pect of any pose being the same is for all intents and purposes non-existent. Since more or less the same variables apply to all other natural objects, it can be safely concluded that: *There can never be any repetition of appearances in nature.*

It was this fundamentally important, though not particularly new insight that Degas was acknowledging. Nor is this uniqueness just a matter of contour. As indicated by the inclusion in the list of “*lighting conditions*”, it applies just as much to surfaces with their properties of colour, lightness, texture and surface-form. Accordingly, since the *Renaissance*, there had been a tradition of artists emphasising the extraordinary variation of colour in nature (particularly with respect to differences in lightness),^{4,5} and their number included some with extremely conventional academic backgrounds.⁶ As we shall see shortly, the absence of repetition of colour in the natural world was also a fundamental plank in the teaching of Professor Bohusz-Szyszko and, through him, a key factor in my own work and thought, both as an artist and as a scientist.⁷

A basic feature of knowledge

If we stop to think, we realise that all knowledge of objects can be described in terms of “*sets of relationships that our brains have extracted from past experience such that they can be of use to us in the future*”. Clearly to fulfil this function *knowledge* must relate to *properties of appearances that do not change over time*. Even more remarkable, it must subsume into the same description whole categories of objects (for example, all chairs, whatever their special characteristics), different views of the same object (for example, of one particular chair) or common characteristics of different objects (for example, all surfaces that can be sat upon whether belonging to a chair, a low wall or any other object).

4 The earliest amongst them were the *Venetian Colourists* of whom the best known is Titian.

5 John Ruskin (1819 -1900) “*Whenever you lay on a mass of colour, however large or small it may be, or however small, it shall be gradated. No colour exists in Nature under ordinary circumstances that is not gradated... I must press on you the preeminent necessity of introducing it everywhere.*”

6 For example, the French Academic painter Jean Baptiste Oudry (1686-1755) pointed out that in a still life composed of white objects: “*The different whites will make you assess the precise tone of the white that you need to render your silver vase, since you will know by comparison that the colours of one of these white objects will never be the same as those of the others.*”

7 It also turned out to be one of the keys that was later to open the door to exciting discoveries of fundamental importance in painting and drawing. In particular, these concerned how we perceive colour, surface-form profile, in front/behind relations, and quality of light. See *Chapter 5* and, in more detail, in “*Painting with light*” and “*Painting with Colour*”.

This being the case, we are forced to conclude that, even with respect to the example of knowledge of particular chairs, there can be no possibility that it can help directly with the analysis of the never-repeating particularities of surface, shape or colour which artists seek to represent. Since, as explained above, these comprise every single detail of what we have been describing as “*measured reality*”, whether our analysis is in terms of contour, surface-form or colour, we discover just how literally the aphorism of Degas can be taken. If we want to portray the uniqueness of what we are looking at, we must conclude that there seems to be no rational alternative to accepting that, like him, “*it is necessary to assume that we know nothing*”.

SKILL

Despite what has just been said, the central importance of the role of “*knowledge*” in drawing and painting must be emphasised. To understand this seeming paradox, it is necessary to extend our definition of knowledge. We need to move on to the kind of knowledge that drives *skilled actions* with particular reference to the part of it that controls the processes that underpin the *analytic-looking* that we use when trying to characterise shape, form or colour relationships.⁸

As we know from often frustrating experience, all new skills have to be learnt and this has to be done through the agency of existing skills. Since the word “*learning*” can be translated as “*the process of acquiring knowledge*”, it follows that *everything we do is knowledge-guided*.

As a way of getting a better understanding of the importance of this fundamental truth in the context of drawing and painting, let us return to Degas statement and, as we do so, consider why we so much admire his drawings. What distinguishes his efforts from those of others? In view of the artist’s declared determination to eschew all knowledge when drawing, the answer may seem paradoxical. It is “*the impressive nature of his store of knowledge*”.⁹

How can this be? One all-embracing, even if rather general, reply to this question focuses on the role of knowledge in guiding analytic looking skills. It is that Degas was able to use his existing knowledge to help him discover what he

8 As we shall see later, it will also have to include the so-called “*hard-wired*” knowledge of appearances known as the “*visual primitives*”.

9 See *Chapter 6* for a more trivial but equally significant manifestation of the importance of knowledge in achieving accuracy.

could not know, namely the particularities of appearance that he was seeking to represent. However a slightly more elaborate answer is worth attempting, for it can help us with our understanding not only of the practical problems of drawing and painting but also of the nature of personal creativity.

Components of “knowledge”

We can start at the beginning with a global definition of the most basic possible kind, namely that “*knowledge is what we know*”. Or, to put the same thing in a more long-winded way: “*Knowledge is information stored in the brain and the central nervous system such that it can be used to influence our behaviour (including our thoughts)*”.

In all of us, the quantity of this stored information is very considerable and it comes from two sources. The first of these is genetic inheritance (what our species has learnt as a result of evolution). The second comprises the totality of what we ourselves have learnt through personal experience. These two are often referred to as “*nature*” and “*nurture*”.

With respect to the purpose of this book, it is pointless to try and work out the precise contribution of genetic inheritance relative to personal experience. What we can say is that: “*Knowledge includes everything that we, as members of a species and as individuals, have ever learnt that can still influence our actions or our thoughts.*” Accordingly, our knowledge not only enables our capacity to *recognize* and *recall* to mind (the knowledge that Degas could not use for representing unique features of appearance) but also contains the instructions that guide all the skills that we have at our disposal – including the visual and manual skills used in painting and drawing. Amongst these is “*knowing how to look for aspects of appearance that could not have been known about beforehand.*”

Memory

Much reference has been made to *knowledge*, but little has been said about *memory*. Actually the two words mean very much the same thing, for *knowledge is the contents of the memory stores of the brain*. However, we talk about *memory* in a rather different way and, as a result, learn various different things from the process.

The word “*memory*” is most likely to be used in reference to *recognition*, *recall* and *skills*. The skills may be *motor skills*, such as those used in walking,

sitting, grasping, typing, engaging in sports, etc. They may also be *intellectual skills*, such as those necessary for thinking and organising what we want to say. Perhaps less well known to the general public are the forms of memory known to researchers as “*short-term memory*”, “*working memory*” and “*iconic memory*”.

There will be much to explain about all these aspects of memory in the following chapters. For the moment suffice it to make three points, namely that all these aspects of memory:

- Are fundamental to all visually mediated skills including drawing and painting.
- Are constantly either being updated or, in the case of iconic memory and short-term memory, replaced.
- Owe their meaningfulness to processes of learning involving “*comparison*”.

Later, there will be much to say about this third category. For now it is worth noting that comparisons can be over time or across space and that they always provide two vital bits of information, namely what is the “*same*” and what is “*different*”. As we shall see, the “*same*” information provides the basis for “*recognition*” and *long-term memory* and the “*different*” information, for both *search strategies* and *description building*.

FEELINGS

John Constable is recorded as saying that “*painting is just another word for feeling*”. Paul Cézanne indicated a role for the feelings in every comparison made by artists when he asserted that “*the artist does not perceive every relation directly, he senses them*”. With these two suggestions in mind, both coming from particularly thoughtful and scientifically minded artists, coupled with the knowledge that seemingly countless other artists have made similar claims, we can move on logically from *memory* to the *feelings*.

Feelings and mistakes

Some people might be surprised at this step. However, it is justified because the feelings are deeply embedded in all *learning processes* and in all *knowledge-guided activity*. The reason is that learning requires making choices and the only

arbiter of choice available to biological systems is the one that mediates feelings.

One trivial example of the role of feelings in learning that can be mapped onto all other examples relates to people making mistakes when attempting to draw accurately from observation. They can only tell that we have made a mistake if they make a comparison between the model and the copy. The same/different judgement that this entails allows them to sense any differences between the lines compared. If they are the same, they feel “*good*” and if not, they feel “*bad*”. Furthermore their degree of dissatisfaction is greatly influenced by the extent of the difference, and this is something they “*sense*” rather than “*measure*” with their eyes.

The complexity of simple feelings

No matter how simple they may sometimes seem, *feelings are always complex in terms of their ramifications*. This complexity follows from the fact that feelings of all kinds inevitably evolve over time and end up being influenced by a tangle of experience with threads leading far back into the past. This is easy to see in the cases of *recognition and recall* which either depend on or, at least, tap into all the history of *associations and connotations* relating to the recognised person or object. *Recognition and recall* are also influenced by the *context* that provides the trigger for their occurrence and the *feelings* are invariably very much a part of this, as can be the sense of achievement we can feel, for example, when bringing things to mind.

The role of feelings in *motor skill-development* may seem less evident. At first we may be surprised at the idea that this is affected by feelings, but we all know the frustrations of failure and the agreeable sensations that accompany success. If we get down to the roots of the matter (as in the above example of mistake identification and correction) we find that the acquisition of skills is completely dependent upon the feedback that tells us how we are getting along in relation to our goals and objectives. Whether we are doing well or badly is signalled by means of reinforcing or deterring sensations. Reinforcement is *felt* as good and deterrence is *felt* as bad.

The bad feeling comes with a perception that we are not performing well or that we have made a “*mistake*”. It is because we perceive these outcomes as being “*bad*” that we wish to avoid their recurrence. In this way, we discover that learning is highly dependent on making errors and correcting them. Indeed, it

turns out that the old proverb that “*we only learn from our mistakes*” is nothing other than a pithy statement of a profound truth.

Some may say that this is a simplification since it is evident that we can also learn from the *mistakes of others*, whether by observing them or being told about them. However, even when we have helpful examples of what not to do before us, we still have to act on them and every action faces us once again with the possibility (indeed probability) of making mistakes.

Also, it is important to point out that mistakes only provide learning opportunities for those who are aware of them. This is why people who are wanting to acquire or perfect a skill of any kind can usually be helped by a teacher or a coach. In their absence they are only too likely to find themselves reinforcing bad habits. Strategies that encourage looking for and correcting mistakes are a way of avoiding this outcome.

A desirable mind-flip : mistakes as learning opportunities

Maybe it is because the example of learning from teachers leaps to mind that we do not take the old proverb sufficiently seriously. Or perhaps the reason is that being such an extremely well known saying means that we have become habituated to it and desensitized to the power of its meaning. If so, this is a pity for there could hardly be a more important lesson. It enables us to realise that, once our negative reaction has performed the function of alerting us to the existence of a problem, we need to change gear and appreciate the positive value of recognising that something is wrong. Mistakes, once recognised for what they are, should be welcomed as learning opportunities. Doing so will require a mind flip of a kind that many people find difficult to master, but nevertheless one which all can acquire with appropriate practice.

Can learning occur without mistakes?

Some of my students have baulked at the suggestion that *absolutely all* learning depends on making mistakes. However, although the argument being presented does not require insistence on this exclusiveness, a case could be made that there is indeed no alternative. It would rest on the two interconnected propositions. The first of these is that another, more scientific, way of phrasing matters might be that “*we only learn with the help of feedback*”.¹⁰ The second is that value

10 The basic proposition of “cybernetics”, the brain child of Norbert Wiener, a field that formalizes the notion of feedback, with many implications for engineering, systems control, computer

of feedback is that it can be used to *refine direction*¹¹ or to *draw attention to unpredictable aspects of things*.

It is not worth getting tangled in debate as to whether feedback is necessary if a person learns from a *parent*, a *teacher*, a *coach* or a *book*, except to point out that, in terms of the learning process, the two functions of the outsider are either to furnish a *model* or to provide *criticism*. If so, we realise that the process of recognising the value of any suggestion made by an external agent depends on recognising that it indicates differences between it and our efforts (in other words, it enables a process of *refining via mistakes*). Other people's criticism gives us a framework of values that gives us the possibility of *mistake identification and correction*. In this way the other person is brought into our personal feedback cycle.

Should we choose to go down to the level of basic neurophysiology, we find that even learning by rote, the most seemingly "*brainless*" type of learning, entails the use of error-correction by feedback subjected to a feeling-driven judgment system.

However, all this is casuistry since what we are really wanting to discuss is *mistakes made by ourselves in drawings and paintings from observation*, and what we are particularly interested in is the way they attract attention to aspects of appearances that would otherwise go unnoticed.

Feelings and value judgements

An equally important point follows from the realisation that mistakes can only exist in the context of *value judgements*. Accordingly, they can always be *corrected* in either one of two different ways:

- In relation to the values of the system being used.
- By changing the value system itself.

This second option has far-reaching implications for processes of artistic creativity and, by implication, all other forms of creativity as well. In passing we can also note that, in as far as *the feelings* become enmeshed in one *value system*, changing to another may be psychologically difficult. There can be little doubt that this is a major reason why history is littered with examples of people finding difficulty in espousing new ideas or new art.

science, biology, philosophy, and the organization of society.

¹¹ The original insight that gave rise to Cybernetics.

Some precisions on the nature of feelings

So far in this discussion about *feeling*, the word has been used rather generally and it is now time to be a little more precise.

The words “*sense*” and “*feel*” have very similar meanings. Their origin lies in the same Latin word, namely “*sensus*”. It is commonplace to describe human beings as having *five senses* and to say that all brain/body systems depend on *sensory input*. Does this mean that we can describe the sensory-input systems as “*feel systems*”?

As a first step to answering this question, I think that we can all agree that there is little difference between the words “*sensing*” and “*feeling*” with respect to touching objects with our hands. But what about *taste*, *smell*, *hearing* and *vision*? Can we either *sense* or *feel* the taste of food? Can we *sense* or *feel* its smell? Can our eyes be said to *sense* or *feel* contours or colours?

For those who find themselves instinctively answering these questions in the negative, it may be useful to consider to the process of making *comparisons* between aspects of things. When we do, it seems natural to talk in terms of either *sensing* or *feeling* the differences, whether they relate to the domains of scents, sounds or colours or to any other modality of visual input.¹² We are comfortable with the idea of using comparative words like “*sweeter*”, “*louder*” or “*lighter*”. Looked at from this perspective, it is easy to make the bridge to it becoming natural to talk of “*sensing*” or “*feeling*” relativities of any kind. For example, we have no problem in *sensing* or *feeling*:

- The difference in length of two lines,
- The difference in lightness two colours.
- The difference between any other two aspects of the colour experience.

If so the idea of sensing or feeling with the eyes when using the visual analytic system to make comparisons, should no longer pose any difficulty.

Comparing feeling and emotion

Earlier the complexity of *feelings* was emphasised. However, if we consider those that are associated with *the relativity judgements* just cited, it would be easy to assume that they are fairly simple. Yet even these may have surprisingly elaborate ramifications. For example, as many abstract artists know from experience,

12 E.g. colour, lightness and texture.

colour relationships in their own right may tap into all sorts of memories replete with multiple associations and connotations. Certainly, when making drawings or paintings from observation, we will find ourselves accessing feelings on many levels and at least some of these are likely to be formidably complex. For example, when depicting someone we know well and love deeply, we will be tapping into feelings associated with huge reservoirs of personal history. Accordingly, we may find ourselves responding in powerful, highly charged or particularly gentle ways. To describe this kind of reaction we need to extend the meaning to the word “*feelings*” to include the “*emotions*”. In some circumstances it is perhaps easy to confuse these two words and this is no surprise. My dictionary gives one meaning of feeling as “*emotion*” and one definition of emotion as “*feeling*”.¹³

So what is the difference between them? My own interpretation is that both these two words and the word “*sensing*” are on the same continuum, such that the word “*feelings*” covers the entire extent of it, while the words “*sensing*” and “*emotion*” are to be found at the two extremes. In this conception, feelings are described as “*emotions*” when they trigger what my dictionary defines as “*excited mental states*” and as “*sensations*” when they are related to awareness of input from one of the five senses.

In summary, there can be many levels of *feeling*, extending from mere *sensing* to full blown *emotion*. All of them contribute to the vital response of the artist and all can be said to be mediated by neurologically based “*feel systems*”. There will be more about this in the next chapter under the heading of “*focusing down*” and in many other places in this volume.

Feelings and working memory

The intimate relation between memory and the feelings has already been of suggested. But there are important subdivisions to consider. For example, the ones that relate to the *working memory*, mentioned earlier. More will be said about this key aspect of *eye/brain* processing in the next chapter. For the moment it suffices to emphasise the fundamental importance of *working memory* in drawing and painting, since without it, there would be no way of dealing with *unpredictable contingencies*. The reason is that this type of memory is necessary for making analyses of *relationships that have never been experienced before* and which will almost certainly never recur (in other words, the totality of the relationships of interest to artists who are seeking accuracy when drawing or painting

13 Concise Oxford Dictionary, OUP, edition 1975

from observation). To fulfil this function, the working memory must have two essential properties. It must be:

- Built for the purpose in hand.
- Temporary.

As in the case of *longer-term memory*, the process of building the necessary memory structures requires learning through *feedback* capable of providing reinforcement or deterrence. Thus, inevitably, once again, *feeling* is intimately involved.

From all this we can deduce a simple statement with profound and far-reaching implications, namely that: *The feelings determine both the nature and the direction of the progress of all learning.*

If the feelings are so central to learning, what else should we know about them? One property of fundamental importance can be derived from considering their intrinsic *complexity*. If feelings can be influenced by *associations* and *connotations* that may stretch back to the dawn of our life, it follows that they must sometimes, if not always, be extremely elaborate. If we consider that the feelings within every individual have been forged by means of a cumulative process during the course of a lifetime, we can marvel at their potential complexity and safely conclude that *the feelings of each person are unique*. However, although the entire package of each person's feelings will always be unlike that of anybody else, there will be significant overlaps with the feelings and responses of others. As we shall see, these overlaps are highly significant, for they allow for the possibility what is generally referred to as "*communication*".

Implications

This chapter concentrates on two issues: the role of knowledge and the role of the feelings. Its two main points are that we can do nothing that is not guided by knowledge including skilled actions, and that all learning involves judgements arbitrated by feel-systems. A main question it leaves unanswered is how knowledge can guide the analysis of unfamiliar objects, a subject which is picked up in Chapter 4. To prepare for this, the next chapter expands what has already been said on the relationship between "knowledge" and "memory" (which represent two ways of thinking about same thing) and how they relate to "skill". It also provides a perspective on the visual systems that are required for the implementation of visually mediated skills.