Gregory Bateson “Mind and Nature” Dutton, N.Y. 1979

Ch. II EVERY SCHOOLBOY KNOWS …

4. THE PROCESSES OF IMAGE FORMATION ARE UNCONSCIOUS

This generalization seems to be true of everything that happens between my sometimes conscious action of directing a sense organ at some source of information and my conscious action of deriving information from an image that "I" seem to see, hear, feel, taste, or smell. Even a pain is surely a created image.

No doubt men and donkeys and dogs are conscious of listening and even of cocking their ears in the direction of sound. As for sight, something moving the periphery of my visual field will call "attention" (whatever that means) so that I shift my eyes and even my head to look at it. This is often a conscious act, but it is sometimes so nearly automatic that it goes unnoticed. Often I am conscious of turning my head but unaware of the peripheral sighting that caused me to turn. The peripheral retina receives a lot of information that remains outside consciousness – possibly but not certainly in image form.

The *processes* of perception are inaccessible; only the products are conscious and, of course, it is the products that are necessary. The two general facts – first, that I am unconscious of the process of making the images which I consciously see and, second, that in these unconscious processes, I use a whole range of presuppositions which become built into the finished image – are, for me, the beginning of empirical epistemology.

Of course, we all know that the images which we "see" are indeed manufactured by the brain or mind. But to know this in an intellectual sense is very different from realizing that it is truly so. This aspect of the matter came forcibly to my attention some thirty years ago in New York, where Adalbert Ames, Jr., was demonstrating his experiments on how we endow our visual images with depth. Ames was an ophthalmologist who had worked with patients who suffered from anisoconia; that is, they formed images of different sizes in the two eyes. This led him to study the subjective components of the perception of depth. Because this matter is important and provides the very basis of empirical or experimental epistemology, I will narrate my encounter with the Ames experiments in some detail.

Ames had the experiments set up in a large, empty apartment in New York City. There were, as I recall, some fifty experiments. When I arrived to see the show, I was the only visitor. Ames greeted me and suggested that I start at the beginning of the sequence of demonstrations while he went back to work for awhile in a small room furnished as an office. Otherwise, the apartment contained no furniture except for two folding deck chairs.

I went from one experiment to the next. Each contained some sort of optical illusion affecting the perception of depth. The thesis of the whole series was that we use five

main clues to guide us in creating the appearance of depth in the images that we cerate as we look out through our eyes at the world.

The first of these clues is size; * that is, the size of the physical image on the retina. Of course, we cannot *see* this image so it would be more exact to say the first clue to distance is the angle which the object subtends at the eye. But indeed this angle is also not visible. The clue to distance which is reported on the optic nerve is perhaps *change in angle subtended*. *1 The demonstration of this truth was a pair of balloons in a dark area. The balloons themselves were equally illuminated, but their air could be passed from one balloon into the other. The balloons themselves did not move, but as one grew and the other shrank, it appeared to the observer that the one which grew, approached, and the one which shrank, retreated. As the air was shifted form one balloon to the other and back again, the balloons appeared to move alternately forward and back.

The second clue was contrast in brightness. To demonstrate this, the balloons stayed the same size and, of course, did not really move. Only the illumination changed, shining first on one balloon and then on the other. This alternation of illumination, like the alternation in size, gave the balloons the appearance of approaching and retreating in turn as the light fell first on one and then on the other.

Then the sequence of experiments showed that these two clues, size and brightness, could be played against each other to give a contradiction. The shrinking now always got more light. This combined experiment introduced the idea that some clues are dominant over others.

The total sequence of clues demonstrated that day included size, brightness, overlap, binocular parallax, and parallax created by movements of the head. Of these, the most strongly dominant was parallax by head motion.

After looking at twenty or thirty such demonstrations, I was ready to take a break and went to sit in one of the folding deck chairs. It collapsed under me. Hearing the noise, Ames came out to check that all was well. He then stayed with me and demonstrated the two following experiments.

The first dealt with parallax (see Glossary). On a table perhaps five feet long, there were two objects: a pack of Lucky Strike cigarettes, supported on a slender spike some inches from the surface of the table and a book of paper matches, similarly raised on a spike, at the far end of the table.

Ames had me stand at the near end of the table and describe what I saw; that is, the location of the two objects and how big they seemed to be. (In Ames's experiments, you are always made to observe the truth before being subjected to the illusions.)

Ames then pointed out to me that there was a wooden plank with a plain round hole in it set upright at the edge of the table at my end so that I could look through the hole down the length of the table. He had me look through this hole and tell him what I saw. Of course, the two objects still appeared to be where I know them to be and to be of their familiar sizes.

Looking through the hole in the plank, I had lost the crow's-eye view of the table and was reduced to the use of a single eye. But Ames suggested that I could get parallax on the objects by sliding the plank sideways.

As I moved my eye sideways with the plank, the image changed totally – as if by magic. The Lucky Strike pack was suddenly at the far end of the table and appeared to be about twice as tall and twice as wide as a normal pack of cigarettes. Even the surface of the paper of which the pack was made had changed in texture. Its small irregularities were now seemingly larger. The book of matches, on the other hand, suddenly appeared to be of dollhouse size and to be located halfway down the length of the table in the position where the pack of cigarettes had formerly been seen to be.

What had happened?

The answer was simple. Under the table, where I could not see them, there were two levers or rods that moved the two objects sideways as I move the plank. In normal parallax, as we all know, when we look out from a moving train, the objects close to us appear to be left behind fast; the cows beside the railroad track do not stay to be observed. The distant mountains, on the other hand, are left behind so slowly that, in contrast with the cows, they seem almost to travel with the train.

In this case, the levers under the table caused the nearer object to move along with the observer. The cigarette pack was made to act as if it were far away; the book of matches was made to move as if it were close by.

In other words, by moving my eye and with it the plank, I created a reversed appearance. Under such circumstances, the unconscious processes of image formation made the appropriate image. The information from the cigarette pack was read and built up to be the image of a distant pack, but the height of the pack still subtended the same angle at the eye. Therefore, the pack now appeared to be of giant size. The book of matches, correspondingly, was brought seemingly close but still subtended the same angle that it subtended from its true location. What I created was an image in which the book of matches appeared to be half as far away and half its familiar size.

The machinery of perception created the image in accordance with the rules of parallax, rules that were for the first time clearly verbalized by painters in the Renaissance; and this whole process, the creating of the image with its built-in conclusion from the clues of parallax, happened quite outside my consciousness. The rules of the universe that we think we know are deep buried in our processes of perception.

Epistemology, at the natural history level, is mostly unconscious and correspondingly difficult to change. The second experiment that Ames demonstrated illustrates this difficulty of change.

This experiment has been called the *trapezoidal room*. In this case, Ames had me inspect a large box about five feet long, three feet high, and three feet deep from front to back. The box was of strange trapezoidal shape, and Ames asked me to examine it carefully in order to learn its true shape and dimensions.

In the front of the box was a peephole big enough for two eyes, but before beginning the experiment, Ames had me put on a pair of prismatic spectacles that would corrupt my binocular vision. I was to have the subjective presupposition that I had the parallax of two eyes when indeed I had almost no binocular clues.

When I looked in through the peephole, the interior of the box appeared to be quite rectangular and was marked out like a room with rectangular windows. The true lines of paint suggesting windows were, of course, far from simple; they were drawn to give the impression of rectangularity, contradicting the true trapezoidal shape of the room. The side of the box toward which I faced when looking through the peephole was, I know from my earlier inspection, obliquely placed, so that it was further from me at the left end and closer to me on the right.

Ames gave me a stick and asked me to reach in and touch with the point of the stick a sheet of type-writing paper pinned to the left-hand wall. I managed this fairly easily. Ames then said. "Do you see a similar piece of paper on the right-hand side? I want you to hit that second piece of paper with the stick. Start with the end of your stick against the left-hand paper, and hit as hard as you can."

I smote hard. The end of my stick moved about an inch and then hit the back of the room and could move no father. Ames said, "Try again."

I tried perhaps fifty times, and my arm began to ache. I know, of course, what correction I had to impose on my movement: I had to pull in as I struck in order to avoid that back wall. But what I did was governed by my image. I was trying to pull against my own spontaneous movement (I suppose that if I had shut my eyes, I could have done better, but I did not try that.)

I never did succeed in hitting the second piece of paper, but, interestingly, my performance improved. I was finally able to move my stick several inches before it hit the back wall. And *as I practised and improved my action*, my image changed to give me a more trapezoidal impression of the room’s shape.

Ames told me afterward that, indeed, with more practice, people learned to hit the second paper very easily and, at the same time, learned to see the room in its true trapezoidal shape.

The trapezoidal room was the last in the sequence of the experiments, and after it, Ames suggested that we go to lunch. I went to wash up in the bathroom of the apartment. I turned the faucet marked "C" and got a jet of boiling water mixed with steam.

Ames and I then went down to find a restaurant. My faith in my own image formation was so shaken that I could scarcely cross the street. I was not sure that the oncoming cars were really where they seemed to be from moment to moment.

In sum, there is no free will against the immediate commands of the images that perception presents to the "mind’s eye." But through arduous practice and self-correction, it is partly possible to alter those images. (Such changes in calibration are further discussed in Chapter 7.)

In spite of this beautiful experimentation, the fact of image formation remains almost totally mysterious. How it is done, we know not – nor, indeed, for what purpose.

It is all very well to say that it makes a sort of adaptive sense to present only the images to consciousness without wasting psychological process on consciousness of their making. But there is no clear primary reason for using images at all or, indeed, for being *aware* of any part of our mental processes.

Speculation suggests that image formation is perhaps a convenient or economical method of passing information across some sort of *interface*. Notably, where a person must act in a context between two machines, it is convenient to have the machines feed their information to him or her in image form.

A case that has been studied systematically is that of a gunner controlling antiaircraft fire on a naval ship. [*2] The information from a series of sighting devices aimed at a flying target is summarized for the gunner in the form of a moving dot on a screen (i.e., an image). On the same screen is a second dot, whose position summarizes the direction in which an antiaircraft gun is aimed. The man can moved this second dot by turning knobs on the device. These knobs also change the gun's aim. The man must operate the knobs until the dots coincide on the screen. He then fires the gun.

The system contains tow interfaces: sensory system-man and man-effector system. Of course, it is conceivable that in such a case, both the input information and the output information could be processed in digital form, without transformation into an iconic mode. But it seems to me that the iconic device is surely more convenient not only because, being human, I an a maker of mental images but also because at these interfaces images are economical or efficient. If that speculation is correct, then it would be reasonable to guess that mammals form images because the mental processes of mammals must deal with many interfaces.

There are some interesting side effects of our unawareness of the processes of perception. For example, when these processes work unchecked by input material from a sense organ, as in dream or hallucination or eidetic (see Glossary) imagery, it is sometimes difficult to doubt the external reality of what the images seem to represent. Conversely, it is perhaps a very good thing that we do not know too much about the work of creating perceptual images. In our ignorance of that work, we are free to believe what our senses tell us. To doubt continually the evidence of sensory report might be awkward.