

# PART II.

THEORIES OF MATHEMATICS.

## II.A.

### Mental Images as Pictures: a Historical Perspective.

#### SII.A.1. The Fundamental Types of Imagery Theory.

We saw in Part I that the importance attached to the concept of mental imagery went into a sharp decline in the early years of this century. Indeed, if the replies given by Galton's scientist friends are anything to go by, it was already out of favour in some circles by the later eighteenth hundreds {1}. Probably the importance ascribed to imagination reached a peak with the Romantic writers of the early nineteenth century {2} and declined from then on. However, we also saw that empirical work done over the past 25 years or so has forced psychologists to once again take the mental image seriously. We also saw that from the earliest origins of the concept in classical Greece the imagination has been considered to be both the image forming capacity and the capacity by which the mind gets in touch with empirical reality.

The notion that the imagination plays a vital rôle in getting in touch with and understanding the natural world was, of course, quite central to the Romantic conception of the faculty {3}, but with the eclipse of imagery as a serious scientific concern the connection between image formation and knowledge has been lost to view. So far, contemporary psychological work on imagery

has done little to remedy this. Little or no consideration has been given to the question of what the "image" of cognitive psychology can tell us about the "imagination" of Aristotle and Coleridge. This question, however, can hardly be tackled until we know what the psychologists' image is, until we have some idea about the underlying mechanisms of imaging. Unfortunately, the psychologists have reached no sort of consensus on this matter. During the 1970s there was a heated debate amongst psychologists as to the nature of imagery, which became known as the "analog-propositional" controversy {4}, in some ways a modern counterpart of the "imageless thought" controversy. This disagreement has never been resolved. Indeed, many, most notably Anderson {5\*} and Palmer {6}, have despaired of ever resolving it on the basis of psychological evidence.

There are two reasons why we need not immediately succumb to such despair. First of all, we shall be looking beyond purely psychological concerns. Even if two theories do not provide different experimental predictions they may nevertheless have very different implications when we apply them to our epistemological concerns. One might throw light on how we can make contact with the world where, another does not. Although this will in no way be a scientific proof of its correctness, in the absence of more direct criteria it is surely reasonable for both philosophers and scientists to take such an illuminating theory more seriously than an unilluminating one.

The second reason to reject despair is more straightforward. Its chief advocates, Anderson and Palmer, simply do not consider the whole range of extant theories of imagery. They both consider the same two types of theory and conclude that one is as good as the other {7\*}. However, they completely fail to discuss theories which are neither 'analog' nor 'propositional' in the relevant senses. The problem may not be that 'analog' and 'propositional' theories (as Anderson, Palmer, and many others conceive them) are equally adequate. It may be that they are both quite inadequate {8\*}. In their recent book *Imagery and Consciousness*, Morris & Hampson designate three extant types of theory as to the nature and mechanisms of imagery {9\*}. These they call "Picture Theories", "Description Theories" and "Rôle Playing Models". The taxonomy of imagery theories which I shall develop below is very similar to theirs. "Picture Theories" and "Description Theories" are essentially the same as, respectively, the 'analog' and 'propositional' views as discussed by Anderson, Palmer and many others, although Morris' & Hampson's terminology seems to me to be more perspicuous. However, I think that the name "Rôle Playing Models" may be a little misleading, and I have preferred to talk of "Perceptual Activity Theories". Although several versions of this type of theory have been proposed they have received far less discussion amongst psychologists than the 'pictorial' and the 'descriptonal' theories, which have generally been played off against one another. Hampson & Morris themselves are the only psychologists who seem to

have bothered to criticize "Rôle Playing Models" in any detail {10\*}. Since I think that these 'perceptual activity' theories have by far the most interesting and welcome epistemological consequences, I must regard this imbalance in the literature as very unfortunate. It perhaps owes more to the energy and tenacity of some of the leading proponents of 'pictorial' and 'descriptive' theories (I am thinking particularly of Kosslyn and Pylyshyn here), than to any intrinsic merits of these two types of theory. That said, however, it must be admitted that 'pictorial' theories have a special status. Both 'descriptive' and 'activity' theories seem to be essentially products of the twentieth century. 'Pictorial' theories, by contrast, have a very long history, and they have come to be built right into our language itself. This makes them particularly difficult to criticize.

It is probable, I think, that what we are here calling 'pictorial' types of imagery theory constitute the popular or commonsense view on the matter, more or less implicitly held by most ordinary people {11\*} - in the sense that philosophers are inclined to suspect that Cartesian dualism is the popular (or in Ryle's {12} term, the "official") theory of the mind body relation. After all, the very term "image" {13\*} seems to imply that we are dealing with something like a picture or sculpture, and it is difficult to even think about imagery without falling into pictorialist assumptions. In the next two sections we will consider the history of 'pictorialism' in the hope

that we can thereby gain some insight into the nature and origins of some of our implicit assumptions about the mental image. Before we do that, however, I should like to point out that there are actually two quite different possible types of 'pictorial' theory of imagery. If a mental image is like a picture we can still ask, whether such a picture is present to consciousness simply by virtue of being 'in the mind' (whatever one conceives the mind to be), or whether some sort of (more or less metaphorical) 'mind's eye' is needed to observe it with. The common idiom "seeing in the mind's eye" (since we do not say we see in, but with, our real eyes) would seem to evidence a distinct ambiguity in the commonsense notion. Lack of clarity on this has, I believe, blunted the impact of much criticism of pictorial theories.

The first of these options leads to what I shall designate as the 'true' pictorial theory: mental imagery (and, generally, perception also) arises when we have actual images (in the sense of objects which resemble their originals as a pictures or sculptures do) in our minds, no more and no less. Such a view seems to have been taken both by classical atomists, where the mind and the images in it are conceived as material {14}, and, arguably (see §II.A.3), by the British Empiricists, whether they were materialist, idealist or agnostic in their views of mental substance {15}. In this latter form this sort of view has had much scorn poured on it by twentieth century philosophers (notably Ryle). It certainly seems crude by

modern materialist standards; few of us would, surely, expect the neural reality underlying the mental image of a green square to be either green or, of necessity, square. And after all, the fact that a physical structure or process exists inside our skulls hardly seems sufficient to explain our awareness of it; that would make neuroanatomy much too easy!

Nevertheless, theories of this type may still have some currency in modern psychology. Indeed Gestalt theory, if construed, as I have argued (16) it should be, as involving an implicit theory of imagery, seems to be a fairly clear case of a 'true' pictorial theory. We have cortical fields isomorphic to (depicting) their stimuli, but which are not regarded as cognised by 'higher' processes - the Gestaltists didn't want to be accused of Cartesian dualism. Rather the fields themselves somehow have a:

conscious aspect (...) it is of the warp and woof of certain events in nature that they 'reveal themselves,' that they are accompanied by consciousness (17).

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Gestaltism, of course, is no longer really with us, but very much with us in the imagery field are the views of Roger Shepard, perhaps the most respected of all contemporary image experimenters. Shepard's positive theoretical writings on the nature of imagery seem to me too tentative and generalized (the fullest version to date is probably in his paper "Psychophysical Complementarity" (18)) to repay systematic criticism, or even to

confidently place them within our taxonomy of imagery theories. We may be confident that he rejects descriptive theories, but some of his pronouncements are very reminiscent of 'perceptual activity' theories, with images seen as structuring our perceptual expectations (see especially his recent paper relating his work to Gibson's (19)). However, his ideas also contain strong echoes of Gestaltism, and he could well be interpreted as holding a similar 'true' pictorial theory - and now explicitly about imagery. Admittedly the isomorphism Shepard's images are supposed to bear to their objects is usually said to be "second order" and "functional" - i.e. isomorphism between the similarity relations of stimuli and their supposed neural representations (20) - but this may be so, on some accounts, in Gestalt theory also (21). What is more, Shepard argues (22) that in a case where the stimulus represented is analysable into parts (e.g. a shape, though not a colour) some degree of "first order isomorphism" (i.e. isomorphism directly between object and representation) is needed to capture its internal structure. The neural representation of a green square would not have to be green, and it would probably not have to be square, but it would have to have four parts corresponding to the four sides, and so forth. It is true that Shepard does not explicitly say that the neural structures which he regards as embodying imagery are to be seen as conscious in themselves rather than as observed by higher processes, but it seems implicit in his discussions. It is consistent with his endorsement of a

very strong version of mind-brain identity {23}, and with his rejection of the modular 'information processing' model of the mind so widely popular amongst cognitive psychologists {24}. (The central metaphor of 'information processing' psychology is precisely the picture of cognition as involving sequential stages, with higher processes operating on the output of lower ones). Mental images for Shepard, then, would be patterns of electrical activity in the brain, isomorphic (in some sense) to their objects, and consciously known simply because they are in the brain. This would mean that he holds a 'true' pictorial theory of imagery very similar to that implicit in Gestalt field theory - and open to similar objection.

Apart, though, from this rather tendentious interpretation of Shepard I think it is true to say that 'true' pictorial theories of imagery have little currency amongst contemporary psychologists. On the other hand, pictorial theories involving a 'mind's eye' - 'higher' mental processes which 'see' the image - are, largely thanks to Stephen Kosslyn, still very much with us. In vision this image is supposed to be passed on from the eyes, mediating between them and the higher conscious levels, whereas in imaging it arises from some internal source. No-one, of course, holds that there is more than a loose functional similarity between the 'mind's eye' and real eyes (some adherents of theories of this type might well dislike the 'mind's eye' metaphor, but provided it is not taken too literally nothing much hangs on it); and the

corollary of this is that the pictoriality of the image it looks at need be no more than functional also {25}. We will follow Kosslyn {26} in designating theories of this type "quasi-pictorial". On such accounts, no spatially extended layout isomorphic to the thing imaged need exist in the brain or anywhere else; as Kosslyn {27} says, mental pictures cannot be hung on the wall! What is claimed is that there should be an informational structure which could specify a picture, which is 'scanned' by the 'higher' processes in a functionally similar way to that in which an eye would scan this picture and pick out its various features. We should not take it as read that quasi-pictorial theories will either succumb, or will be automatically immune, to criticisms directed at an undifferentiated "pictorial" notion of mental imagery. They demand full discussion in their own right and in the sophisticated versions in which they have been developed by contemporary psychologists such as Kosslyn {28} and Hampson & Morris {29}.

### **§II.A.2. The Ancients.**

Such a widespread idea as that visualization involves something picture-like is, inevitably, traceable back to the Greeks. Although there is no known discussion of imagination, or memory or fantasy images, before Plato {1} the idea that something image like is involved in