

falls out very naturally from a theory of this type.

SII.D.6. The Activity Theory and the Experimental Evidence.

We must, of course, consider how a theory of imagery like that which we have just outlined deals with experimental results such as those which we considered in chapter I.C, and which, we argued, form the basis of the acceptance of imagery as a legitimate topic of enquiry in contemporary experimental psychology. First of all, I can see no reason to think that a theory of this type is incompatible in any fundamental way with Paivio's Dual Coding theory of memory {1}. Indeed, it seems to me that the few opinions which Paivio has expressed about the nature of imagery {2}, fit this theory better than either the quasi-pictorial or descriptive theories, both of which, indeed, he explicitly rejects {3}. We have argued above {4} that provided it can be combined with an adequate conception of imagery (and one which is also capable of explaining how image intentionality is intrinsic, how word meaning can derive from imagery rather than *vice-versa*) then Dual Coding theory is quite adequate to explain the mnemonic effects of image use and of the imagery value of words. It can also account for the "symbolic distance effect", and so forth. The only really significant basis of rejection for Dual Coding theory theory has been that it had no adequate conception of the nature of imagery, and

that is just what we have been trying to remedy here.

The effects, mostly investigated by Kosslyn {5}, of the imagined relative sizes of parts of images on the times taken to report their presence image, can, I think, be dealt with by the the sort of theory now under consideration just as well as by Kosslyn's own quasi-pictorial theory. The only real difference is that where the quasi-pictorial theory gains its plausibility from its appeal to an analogy with ordinary perceptual processes, the perceptual activity theory appeals directly to those perceptual processes themselves. In perception it takes longer to see small details, we have to peer, and perhaps even move closer. Kosslyn's theory provides an analogy for this in the notion of "zooming in" on, or 'enlarging' the image, expanding it so that the relevant detail fills more of the 'visual buffer'. But clearly, any theory which equates imaging with a performance of the activities which would normally be involved in perceiving is going to predict similar results. To 'see' an imagined detail we are going to have to 'pretend' to peer at it, or to move towards it - or at least, the schema is going to have to issue directions that we carry out such actions, and react as if they really are carried out. In either case this will all take time, a time dependent on the original smallness of the detail. This, I think, is a perfectly adequate and simple explanation of these the relevant results, although, in fact, Neisser himself offers a rather different explanation in terms of interference effects {6}.

But in any case, it is clear that the theory has the conceptual resources to deal with results of this sort.

In fact, there is one result amongst those which Kosslyn collected on the 'imaged size' effects which positively favours perceptual activity theories. One of his early experiments {7*} involved measuring the times taken to confirm the presence of some feature of an imagined animal. As we saw in §I.C.5, the times taken turned out to depend on the relative size of the feature being looked for, big ones being found more quickly. Kosslyn gave one group of his subjects the name of the animal first, allowing them a few seconds to form an image before he told them the name of the feature which they should be looking for on it. However, for some reason he gave another group of the subjects, who were likewise instructed to indicate when they had found the feature on their image, the name of the part **immediately after** the name of the animal, allowing no time for prior image formation. No doubt he expected that this group would take longer to report 'seeing' the feature than the first group, for in this second case the subjects would (on his theory) first have to form the image and then examine it, whereas the first group would have the image formed ready for examining. In fact he found no difference between the response times of the two groups, a result which he describes, with modest understatement, as "slightly disconcerting" {8*}. His attempts to explain it away {9} are particularly unconvincing, but, since the main point of the experiment was to demonstrate the differences

(which appeared clearly enough) between these imagery groups and subjects doing a similar task without instructions to use imagery, this "disconcerting" result has up to now received no further attention. However, it seems to me that a perceptual activity theory would actually predict it. In theories of this type there is nothing there which is being examined when we visualize something. The quasi-perceptual experience is the result of the very act of making to look at something as if it were really there. On a quasi-pictorial theory there is an image and there is an act of 'looking' at it; on a 'perceptual activity' theory there is only the act of looking, from which the imaginal experience arises directly. It would thus predict no advantage for subjects who had previously been given time to 'form an image' for there is nothing to be formed. 'Having an image' of something is merely to be 'pretending' to look for the various features of that thing, and once one specific feature is requested it can be 'looked for', and thus visualized, straight away, regardless of whether one has previously been going through the motions of looking the thing over or not. This result is, I think, important because it is one place where a 'perceptual activity' theory makes a prediction that clearly differs from that made by a pictorial type of theory. The evidence, such as it is, clearly favours the 'perceptual activity' account {10*}.

The 'mental rotation' and 'mental scanning' effects may be slightly more problematic, and, in fact, in their

critique of Neisser's theory, Hampson & Morris (11) do allege that he is unable to properly account for mental rotation (and they might well have made the same point about 'scanning' if it had been an equally well established fact). In their more recent book they seem to present this as perhaps the main reason for rejecting his theory (12). It might be thought that 'scanning' could easily be accounted for in terms of 'pretending' to sweep the eyes steadily across a scene, and, indeed, Kosslyn himself seems to have originally regarded it as an inner analogue of such a process. However, his computer model, and the smoothness of the inner scanning which his experiments seemed to reveal, have led him to abandon such a view (14). This 'smoothness' is quite unlike the normal, jerky, saccadic eye movements, and although smooth 'tracking' eye movements do occur when following moving objects or the like, they cannot be made at will (13). In any case, this sort of explanation could hardly be extended to mental rotation. Neisser does not discuss 'scanning', but he does suggest that mental rotation may involve the activation of schemata specialized for the perception of rotating objects (15) (and perhaps, by the same token, we might explain 'scanning' as involving schemata specialized for controlling the pick-up of information about objects or scenes moving steadily across our field of view). This may seem limp, and Hampson & Morris certainly think so, but when we set Neisser's theory against its Gibsonian background it may look better. Much of the emphasis in Gibson's work is on just such motion perception, and motions of the

perceiver or of environmental objects are considered to be precisely the sort of thing which reveal the all important invariants. In particular, a smooth flow of the texture of the optic array, much like that involved in mental scanning experiments, is regarded by Gibson as one of the most important effects by which we keep track of our own locomotion {16}. Gibson does not have much directly to say about rotational movements, but Shepard {17} has argued strongly for their ecological significance. Thus, when seen in their proper Gibsonian context, Neisser's suggestion does not seem nearly so *ad hoc* as it might otherwise appear.

Neisser does admit that he has not been able to account for the way in which, for any one subject in any particular type of experiment, mental rotation (and, we may add, 'scanning' too) seems always to proceed at a particular, regular speed. However, he quite justly remarks that no-one else (not even Shepard or Cooper) has a theory which explains or even seriously addresses this point, so his own failure to explain it can hardly be held against him {18}. The only real advance on this point since Neisser wrote this has been the work which suggests that the unexplained effects themselves might be artifactual {19*}. On the other hand, some recent intriguing work by Freyd & Finke {20} on a phenomenon which they call "representational momentum" may provide some clues on the matter. In any case, this mystery cannot be held against the current theory without condemning all the others.

Furthermore, the explanations given by the other accounts of imagery of the basic 'rotation' and 'scanning' phenomena are also more than somewhat *ad hoc*. As we noted in §II.C.3, 'descriptive' theories of imagery effects are all almost entirely *ad hoc*. The basic notion of 'propositional' representation places so little inherent restraint on what can be represented, that pretty much whatever happens can be accounted for by adding suitable auxiliary assumptions (whereas virtually nothing follows from the basic form of representation itself). Certainly 'propositional' theorists would never have predicted the imagery effects, and the auxiliary assumptions they have to make to account for them seem almost entirely arbitrary. Kosslyn's theory was seemingly specifically developed to explain such effects, and certainly it can. However, merely adding program modules called ROTATE, or SCAN, or whatever to the basic picture-drawing program, so that the picture's orientation or position can be suitably adjusted, is a pretty arbitrary procedure in itself. Suppose I were to announce that I had discovered that people have an ability to turn all the colours in their mental images blue. Kosslyn could easily explain it. He could simply add a module called GOBLUE to his program. In this light, Neisser's quasi-Gibsonian account of rotation and scanning may seem the least arbitrary available.

One of the consequences of Neisser's theory as presented in *Cognition and Reality* is that imagery is very

much bound up with perceptual attention - in a way, imaging is regarded as a systematic attempt to attend to things which are not there. But Neisser admitted that the theory of attention which his cyclical theory of perception and imaging implied was one of the most unorthodox parts of his book, and flew right in the face of conventional accounts. Briefly, the standard theories account for the facts of selective attention (such as the so called "cocktail party effect" {21} whence we are able to listen to a single conversation without being confused by all the other chatter going on around us) by postulating 'filters' which exclude unwanted sensory information from consciousness. They go, of course, with those theories which regard the sense organs as essentially passive, and place all the active aspects of perception inside the head. Neisser {22} suggests that on his active account of perception such filters are unnecessary. We only pick up information which we are looking for {23*}, for which our schemata are ready. The rest does not need to be filtered out since it is never picked up in the first place. We are able to follow a conversation at a party because we are attuned to the sound of a certain voice and not others, and, more important, most of the time we have a pretty good idea what the next word is going to be, and our schema is readying us to pick up one out of a fairly small number of alternatives. We are **not** making ready to pick up the sounds being made in the other conversations which are going on around us, but which we are not trying to follow and 'second guess'. And note that if someone to whom we are listening says something

really unexpected, then very often we will not hear that properly.

This approach to attention has inspired rather more experimental work than Neisser's imagery theory, and a number of experiments, particularly by Neisser himself and his students, have lent it some support {24}. I cannot claim to have a thorough knowledge of the general literature on attention, but a recent review by Johnston & Dark {25} argues that what they call "effect theories" of attention, under which they include the views of Neisser as well as those of William James and Julian Hochberg {26*}, can account for the known empirical data equally as well as the more widely held "cause theories" (i.e. filter theories). In fact these reviewers express a tentative preference for the "effect theories". It would thus appear that in the field of attention, at least, some of the weight of opinion is moving Neisser's way.

The link which Neisser's theory makes between imagery and control of attention is particularly significant because there are some neurophysiological results which seem to lend it support. These studies were carried out in Italy on brain damaged patients who exhibited the strange phenomenon known as "unilateral neglect". People suffering from this condition are apt not to notice objects, events, or even parts of their own bodies which are to one particular side of them, the side opposite to the relevant damaged area of their brains. They

can, I understand, perceive things on this side if their attention is explicitly drawn to them, but they do not seem to do so spontaneously. Unilateral neglect seems to be caused by damage to the brain's posterior parietal cortex, a region which animal work has shown to be particularly implicated in the control of the spatial direction of attention {27}. In the light of our consideration of the way that perceptual activity is bound up with object recognition or "instantiation", it is also notable that this brain area, at least in the right hemisphere of humans seems to also be centrally involved in perceptual categorization {28}.

However, the study with which we are now most concerned, by Bisiach & Luzzatti {29}, involved two patients who had recently begun to suffer from left unilateral neglect, caused by brain damage in their right cerebral hemispheres (in each case caused by a stroke). Both these patients were asked to imagine themselves in the cathedral square, the Piazza del Duomo, in Milan - a location with which they were both thoroughly familiar. They were each asked to describe the square, first as seen from a point opposite the cathedral, and, later on, as seen from the opposite perspective, from in front of the cathedral doors. One of the subjects was also asked to imagine and describe the layout of his own studio as seen from two different ends. In each case, the subjects were able to thoroughly and accurately describe the features on what would have been the right-hand-side and the central

areas of their image of the perspective in question. By contrast, hardly any objects on the left side were mentioned at all, and

while central and right-sided items were enumerated in a rather lively manner and sometimes dwelt upon, the few left-sided items were mentioned in a kind of absent minded, almost annoyed tone {30}.

Note that the attitude to the same items would switch around according to the vantage point from which the scene was imagined. It would seem that the defect in spatial perceptual attention which is suffered by these patients is paralleled by an equivalent defect in mental imagery. Although it would, no doubt, be possible to devise explanations for this result in terms of 'propositional' or quasi-pictorial theories of imagery, it certainly seems to jibe most naturally with a theory like Neisser's, in which a link between imagery and the control of perceptual attention plays a central part.

It is also notable that a later, larger and more systematic, study of unilateral neglect by the same authors {31} concludes that the condition is best understood in terms of damage to the mechanisms underlying the patient's "schema". It is not primarily a sensory deficit, they argue, because,

in the cases of patients like ours the loss of sensory information about one side of space could easily be remedied through exploratory activity initiated by the intact neural structures, if all expectations relative to that side of space were not lacking as a result of the lesion.

{32}.

They also note that a 'propositional' account of visual

memory, like (specifically) Pylyshyn's, would find it very difficult to deal with the fact that features of images of places seen from one perspective may be quite accessible, yet become quite inaccessible in an image based on a different viewpoint, from which the feature is now on the 'neglected' side {33}.

We should make it clear that the conception of "schema" as used by these authors seemingly owes nothing to Neisser, and so their usage of it cannot be entirely equated with his {34*}. However, both usages of the term have a common ancestry in the work of the British neurologist Sir Henry Head {35}, Neisser picking up the term indirectly via the Cambridge psychologist Sir Frederic Bartlett {36*}. Thus the apparent similarity of their conclusions is no mere verbal accident. At least since Head's time, "schema" has carried the connotation of behaviour being under the control of a single complex mental structure which is continually modified by experience, as opposed to being under the control of a host of individual, atomistic memories such as we find in 'propositionalist' accounts of the mind. Physical atomism may be a fine enough thing for chemistry and physics, but as the Gestalt Psychologists long ago saw, logical and psychological atomism lead us only into the wastelands of meaninglessness, where it seems that a man can never get in touch with a reality outside himself (or, at least, outside his society). Schema theories, as psychology, certainly need some tidying and some tightening up, but they are not

without promise even in the purely psychological context. However, it seems to me that from the philosophical point of view they are the natural heirs to the Gestalt Theory (which failed not on the philosophical or psychological, but on the physiological level). Like Gestalt Theory, 'perceptual activity' theories such as Neisser's offer us the possibility (if they should prove to be empirically viable) of conceiving that we might be able to steer a path between positivism and relativism, and actually get to know something about the world, rather than just about pointer readings or about the things people say. We perceive, and thus know, the world because, and inasmuch as, we interact with it.