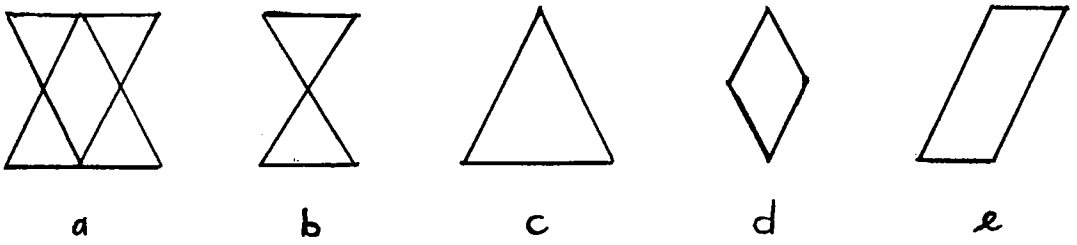
§II.B.5. Cognitive Penetration 2: Experimental Evidence and Reparsing.

We have just seen that, although there may be some rather unwelcome consequences, the sort of "cognitive penetration" effects revealed by introspection can possibly be accounted for within a quasi-pictorial theory of imagery. We can account for them by postulating impressionistic or schematic images qualified and supplemented by visual descriptions. To a certain extent this sort of model can be extended to the more clear cut cases of "penetration" which have been experimentally demonstrated and which we shall discuss here. However, it seems to me that these explanations soon become extremely strained and implausible, and the cognitive function which can be ascribed the pictorial image continues to diminish, almost to vanishing.

Experiments have repeatedly demonstrated the difficulty people have in what has come to be called "reparsing" their images. Real pictures, or other visual displays, can frequently quite easily be interpreted or 'read' in more than one way. Images usually cannot. This sort of effect was noticed even in the early part of this century by workers such as Fernald {1}, who found that after memorising a display such as a "letter square" (i.e. a regular square array of random letters of the alphabet) subjects found it very much easier to read off the contents

Figure II.B.5_1
(Based on Reed [1974].)



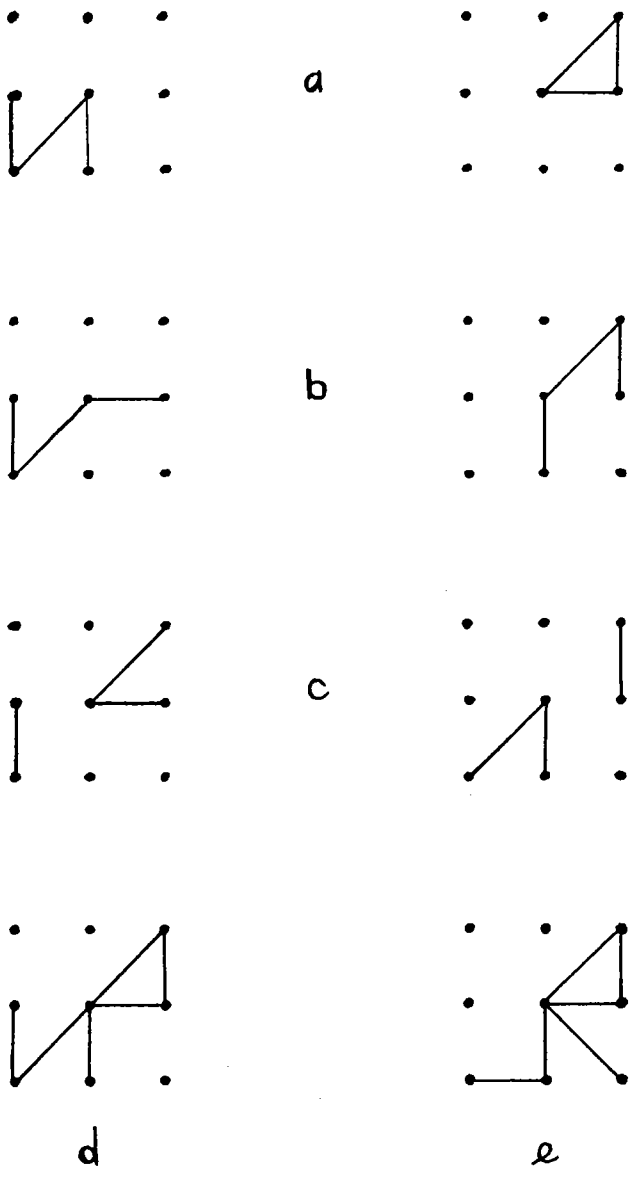


Figure II.B.5_2
(Based on Palmer [1977].)

of their presumed images in terms of left to right rows from top to bottom (i.e. as in normal reading) than in any other order. When the real letter square is before us, of course, it is simple enough to read off from it in any desired direction.

That sort of result is very easily and plausibly explained in terms of verbal learning, of course. It could be that although some blurry or faded mental picture is present it is playing no real part in the recall of the details. More recent experiments are less easily dismissed however. Reed {2} gave his subjects simple geometrical figures such as II.B.5_1(a) to learn. He subsequently showed them a number of simpler figures, the task being to say whether or not they were sub-parts of the original. In our example (b), (c), (d) and (e) are all in fact sub-parts of II.B.5_1(a), but Reed's subjects were much faster and more accurate in identifying (b) and, to some extent, (c) as such than they were with (d) and especially (e). Although (a) can be interpreted to be two crossing parallelograms just as well as to be two adjacent 'hour-glasses' or two interpenetrating triangles people do in fact seem strongly inclined to see and memorise it in the latter two ways rather than the former one; and although it is not too hard to see the parallelogram in the picture (a), once you are asked, unless you originally noticed it there it is hard to find it in an image {3*}. It is very difficult to "reparse" the image, to see it differently from the way in which the picture was

originally seen.

Something like the reverse of Reed's experiment was carried out by Palmer. His subjects were given pairs of sub-parts such as in II.B.5_2(a), (b) or (c), and asked to combine them "by imagining the right display superimposed on the left display" {4} into more complex figures such as (d). When the sub-parts were 'good' gestalts (Palmer develops a metric for 'goodness' of form for figures of this type), as in (a), then the subjects could perform the synthesis much more quickly than with less 'good' parts such as in pairs (b) or (c). They also made fewer errors in distinguishing images formed from 'good' sub-parts from similar combination figures such as (e) (in our example pairs (a), (b) and (c) each combine to form (d)). If we were really working with quasi-pictorial images one would surely expect no more difficulty in superimposing pairs (b) or (c) in the visual buffer than is found with pair (a), but this is not what is found.

Both Palmer and Reed (and Hinton, below) take their work to show that visual images are not represented in the brain in a quasi-pictorial form, but rather in the form of "structural descriptions", language-like representations describing the figures in terms, presumably, of the interrelations of their 'good' parts, easily nameable in the 'language of thought' {5}. (In the Reed example the parallelograms interpretation is presumably supposed not to have been initially encoded, and is not easily deducible

from the 'hour-glasses' or 'triangles' descriptions, which both were. In Palmer's experiment the figures like those in (b) and (c) presumably are taken to themselves require more complex and 'confusing' descriptions than those in (a).)

Kosslyn does have an answer, of sorts, to Reed, however {6}, and it is along the same sort of lines as Fodor's reply to Dennett over the striped tiger. The original Kosslyn & Shwartz simulation did consider the "surface image" to be built up in the visual buffer on the basis of an underlying descriptional representation stored in Long Term Memory. Furthermore, this description is supposed to be expressed, and the image built up, in terms of sub-images of parts. Kosslyn does **not** hold that mental images are 'photographic' copies of retinal images. Some "information processing" has already been done on the retinal input before the mental image is stored:

> Perception is a form of information reduction whereby a welter of sensations is reduced into a simpler and more organized form. These organizational processes result in our perceptions being structured into units corresponding to objects and properties of objects. It is these larger units that will be stored and later be assembled into images that are experienced as quasi-pictorial, spatial entities resembling those evoked during perception itself. {7}

In the case of the car which the simulation program draws, for example, the "skeletal image" giving the general shape can be elaborated by having various details, various parts (such as "REARWHEELBASE") added onto it by the "PUT" procedure as required (see figure II.B.1_1). Furthermore, the activation of the visual buffer which comprises the

images of these parts is hypothesised to fairly quickly fade away. If an image is to be maintained it must be constantly 'refreshed', one 'part' at a time in succession. If an image is too large and elaborated (detailed) some parts will fade before we can get round to 'refresh' them again and it will be lost. Reed's results can be accounted for because:

> when images are later generated [i.e. from the stored description] the parts maintain distinct identities due to the relative fading phase. Hence it will be relatively difficult to detect patterns composed of segments belonging to different imaged parts. {8}.

A similar line of reasoning could be applied to Palmer. Each of the figures in both (b) and (c), it could be maintained, must themselves be encoded as more than one part, whereas in (a) each is encoded as one part only. Thus when given (a) only two image parts need be maintained at one time to imagine (d), whereas in the other cases more parts must be juggled.

But we should notice that on these accounts the descriptional representation is carrying all the explanatory burden. The image might as well not be there. In the case of the tiger image it was assumed that even if more detailed information like the number of stripes was to be extracted only (if at all) from the description, at least something (the number of legs, say, or the colour or posture of the beast) could be read off from the image directly {9}. But Reed's and Palmer's figures are simpler, surely, even than Fodor's stick man tiger (let alone the

much more solid tigers that I - and probably you - can imagine) {10*}. If even the images of these fade before anything useful can be read off them what possible point can there be in having images at all?

Even if we can accept the implications of the 'fading parts' answer to Reed's and Palmer's experiments, there are a couple of more recent examples of the problems of image 'reparsing' for which it would seem not to work. To the best of my knowledge Kosslyn has never really tried to tackle these. The first is an informal demonstration by Geoffrey Hinton whose "Very Hard Imagery Task" I now present:

> TASK 1: Imagine a wire-frame cube resting on a tabletop with the front face directly in front of you and perpendicular to your line of sight. Imagine the long diagonal that goes from the bottom, front, left-hand corner to the top, back, right-hand one. Now imagine that the cube is reoriented so that this diagonal is vertical and the cube is resting on one corner. Place one fingertip about a foot above a tabletop and let this mark the position of the top corner on the diagonal. The corner on which the cube is resting is on the tabletop, vertically below your fingertip. With your other hand point to the spatial locations of the other corners of the cube. {11}.

Perhaps the reader might find it worthwhile to attempt this task for himself, before reading on, and then to check his results against a real cube or cuboid. Hinton reports that:

> I have tried this experiment (with some minor variations of wording) on over twenty people, many of them research workers in vision. Only one of them produced the correct answer and only a few realised that there were six remaining corners to be accounted for. (...) Many subjects took very much longer than a few seconds to produce an answer and when they did they

were clearly not confident about it. {12}

Work by Shepard, and by Kosslyn's close associate Pinker, assures us that there is no special problem involved in dealing with images of 3-dimensional objects and rotating them out of the 'picture-plane' {13}, so it is entirely unclear, on a pictorialist theory, why this task, involving such a simple image of such 'good' gestalt, should be so difficult. However, for reasons which should become apparent in the next chapter, Hinton has no difficulty in explaining it in descriptionist terms.

Perhaps the most convincing demonstration of all of the problems of reparsing images comes from the recent experiment of Chambers & Reisberg {14}. They investigated images of 'ambiguous figures', such as Jastrow's duck-rabbit, familiar to readers of Wittgenstein and Kuhn as well as to psychologists (but not to the experimental subjects). The subjects were first shown ambiguous figures of a similar type so that they got the idea of how they could be reversed. They were then shown the duck-rabbit (or other test figure), but for too short a time for them to see more than one interpretation. Next they were asked to form an image of what they had just been briefly shown, and then encouraged to find another interpretation in their image. Despite considerable prompting (including detailed suggestions as to how to shift their "mental fixation" in just the way that shifting one's eye fixation over the real picture would cause it to reverse) **not one** subject (out of 35) was able to see an interpretation in their image apart

from the one which they had initially seen. The subjects were then allowed to draw the figure on the basis of their image, and were all quite easily able to see the alternative interpretation in their own drawings {15*}. This seems to make particularly clear how pictures can easily reparsed whereas images cannot.

Hinton's demonstration can perhaps be explained in terms of a very vague, and quite redundant, pictorial image associated with a description unsuited to the given task. It seems to me, however, that the Chambers & Reisberg results cannot be well explained even on this basis. After all, the subjects were able to draw a **reversible** figure from their own images (both they and others could see both aspects). If the image were too vague (and some of the subjects tested as vivid imagers) and the drawing were made wholly or primarily on the basis of a single aspect description surely there is no reason to expect the drawings to turn out thus reversible. Rather it is as if the way-of-looking-at-it is inherent in the image itself.

§II.B.6 Imagery and Spatial Knowledge in the Blind.

Kosslyn's account of the image concerns itself specifically and exclusively with the **visual** image. He can hardly be blamed for this - hardly any cognitive psychologists have much to say about imaginings involving