The Imagery Debate

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Chapter 1

Imagery in the History of Philosophy

Imagery has played an enormously important role in philosophical conceptions of the mind. But philosophers have not always agreed on just how broad this role is; nor have they always agreed on the nature of imagery itself. The two most popular views in philosophy prior to this century have been what we might call the “picture theory” and the “weak percept theory.” According to the former view, mental images—specifically, visual images—are significantly picture-like in the way they represent objects in the world. According to the latter view, imagining is like perceiving in less than optimal conditions. Amplified a little, the basic claim of the weak percept theory is that the impressions made in memory from data supplied by the senses weaken with time of storage so that mental images generated from these stored impressions are generally less sharp than the corresponding percepts. Although both positions were widely accepted prior to this century, some philosophers had serious reservations about the lack of determinacy alleged to be present in mental images by advocates of the weak percept theory. There was also some debate about just how mental images pictorially represent external objects.

In section 1.1, I summarize the major traditional philosophical accounts of imagery, and I discuss the most significant disagreements that arose among advocates of these accounts. This is intended not only to illuminate the early philosophical perspectives but also to provide an historical background against which contemporary views on imagery may be located. In section 1.2, I examine the evidence upon which the traditional accounts rest.

Before we proceed, a quick comment is in order on my usage of the terms “image” and “imagine.” Starting with chapter 3, the term “image” is applied exclusively to visual images. In chapters 1 and 2, the context should make it clear whether the term is restricted to the visual case or not. The same holds true for the term “imagine.”
1.1 Traditional Philosophical Accounts of Imagery

Aristotle appears to have held that mental images are like inner pictures. Consider, for example, these passages:

\[\ldots\text{we can call up a picture, as in the practice of mnemonics, by the use of mental images}\ldots\]

The nature of memory and its process has now been explained as the persistent possession of an image, in the sense of a copy of the thing to which the image refers, and it has been further explained to what faculty in us this belongs, viz. to the primary power of sensation. \[\ldots\]

The account of representational content Aristotle endorses here is one that proved very popular with later philosophers. Mental images, according to Aristotle, must resemble or copy what they represent. The thought lying behind this claim is presumably that real pictures must resemble what is pictured and not just represent it by playing a conventional symbolic role. Thus, if mental images are inner pictures, they must represent in like fashion.

Aristotle seems to have come to the view that mental images are picture-like via the evidence afforded by introspection. When we introspect, we find that having a mental image is like looking at a picture. So, of course, mental images are themselves like pictures. This introspective defense of the picture theory is one that Aristotle shared with all subsequent philosophers who accepted the picture theory prior to the advent of recent work in cognitive psychology on imagery. Later in this chapter, we shall consider at some length the merits of such a defense. For the moment, I merely wish to comment on a passage in On the Soul in which Aristotle makes a related claim:

\[\ldots\text{when we think something to be fearful or threatening, emotion is immediately produced, and so too with what is encouraging; but when we merely imagine we remain as unaffected as persons who are looking at a painting of some dreadful or encouraging scene.}\]

In this passage, Aristotle draws the parallel mentioned above between imagining and viewing a picture. Moreover, he claims that imagining never directly produces fear or any other emotion. Now why does Aristotle make this claim? It is tempting to suggest that he is again relying on introspection. Having introspected his own mental images, Aristotle draws a general conclusion about imagination and emotion. This conclusion is false, however, as is shown by recent therapeutic work that uses imagery to help people overcome phobias. It has been found that phobic people frequently become upset when they form mental images of the feared objects or situations. Indeed, they become almost as agitated as they would were the feared objects physically present. The degree of fear they experience varies with the ways the objects are imaged. For example, if you have a dog phobia, you'll be much more agitated if you image a full-grown Doberman near your hands than if you image a small poodle puppy curled up asleep inside a cage. Thus, the procedure adopted in therapy is to get patients initially to form images they feel relatively comfortable with and later to form more and more threatening images without their becoming tense or fearful. Once the patients show no anxiety with images of the feared objects, they can typically face the real objects without fear too.

The sort of introspectively based armchair theorizing that seems to underlie Aristotle's view of imagination and its separation from emotion is commonplace in the history of philosophy. And just as it leads Aristotle astray here, so too it leads others astray elsewhere, as we shall shortly see.

There are passages in Aristotle's work that, under some translations, suggest that Aristotle holds that mental images are crucial to all thought.\[\ldots\] Such a view seems incompatible with the position just cited in which Aristotle draws a sharp distinction between thinking something to be fearful and imagining the same. There is also independent reason to doubt that the relevant translations accurately capture Aristotle's intent.\[\ldots\] Whatever Aristotle's real position here, another philosopher, who certainly does maintain that imagining something is quite unlike thinking or conceiving of it, is Rene Descartes. This comes out very clearly in his discussion of the case of the chiliagon in Meditation Six.\[\ldots\]

According to Descartes, we can easily imagine a pentagon in a way that is introspectively distinguishable from our imagining a hexagon. But, Descartes tells us, we cannot imagine a chiliagon (a 1000-sided figure) in a way that is distinct from imagining a 999-sided figure. By contrast, we have no difficulty at all in conceiving of a chiliagon and how it differs from a figure with one more or less sides. The conclusion Descartes explicitly draws is that imagining is not the same as (nor a component of) thinking or conceiving. A further conclusion is indicated, however. For one plausible explanation of our inability to imagine a 1000-sided figure in a way that is experientially distinguishable from our imagining a 999-sided figure is that imagining is like seeing in a glance. Thus, just as seeing a chiliagon
is experientially no different from seeing a figure with one fewer side, so imagining the former figure is no different from imagining the latter. This view, that imaging is like seeing, is one that Descartes seems to have held even though it does not surface in connection with his discussion of the chilagon. For example, in Meditation Three, Descartes states that only those thoughts that “are, so to speak, pictures” are properly called “ideas” and also that some ideas “proceed from certain things outside us.” The latter ideas are percepts. Thus, Descartes takes mental images to include percepts as well as images conjured up by the will. This seems intelligible only on the assumption that imagining and perceiving are, at root, the same. 

There are further a priori reasons for drawing a conceptual link between imagining and seeing. Just as I may be said to see an object even though not every part of the object is directly in my field of vision, so too I may be classified as imagining an object in parallel circumstances. Similarly, just as seeing is from a point of view, so too is imagining. For example, I cannot see the inside and outside of a room at the same time, unless I use mirrors, and neither can I imagine the inside and outside of a room at the same time, unless I imagine myself using mirrors.

Descartes’s adherence to Aristotle’s view that mental images copy the objects they represent comes out in the following passage from Meditation Three:

My principal task in this place is to consider, in respect to those ideas which appear to me to proceed from certain objects that are outside me, what are the reasons which cause me to think them similar to these objects."

Descartes here is wondering what justification he has for believing that percepts are similar to the objects they represent. Later in the Meditations, having proven the existence of God, Descartes finds the justification he desires. This justification need not concern us in the present context. The salient point for our purposes is that Descartes, like Aristotle, holds that percepts (and mental images) copy objects in the external world.

Thomas Hobbes’s discussion of imagery is noteworthy in three respects. First, Hobbes emphasizes the vagueness or lack of determinacy in many mental images as well as the parallel with seeing. For example:

... after the object is removed or the eye shut, we still retain an image of the thing seen, though more obscure than when we see it."

And any object being removed from our eyes, though the impression it made in us remain, yet other objects more present succeeding and working on us, the imagination of the past is obscured and made weak, as the voice of a man is in the noise of the day. From whence it follows that the longer the time is after the sight or sense of any object, the weaker is the imagination."

Second, Hobbes presents the beginnings of an account of the generation of mental images. On Hobbes’s view, mental images are not like slides or photographs that are stored in memory and taken out whenever the experience of imagery occurs. As Hobbes is aware, this model cannot explain our ability to form images of entirely novel scenes (as, for example, when a frog is imaged leaping over a rhinoceros). Rather, in Hobbes’s view, images may be generated by combining separate percepts stored in memory. He says:

Again, imagination being only of those things which have been formerly perceived by sense, either all at once or by parts at several times, the former, which is the imagining the whole object as it was presented to the sense, is simple imagination, as when one imagines a man or horse which he has seen before. The other is compounded, as when, from the sight of a man at one time and of a horse at another, we conceive in our mind a centaur."

Third, in sharp contrast with Descartes, Hobbes locates imagery within the brain."

With Locke, Berkeley, and Hume, imagery takes center stage in the mind, or rather, it occupies the entire stage; for, unlike Descartes and Hobbes, the British Empiricists held that all thought consists in the manipulation of either simple images derived from sense experience or complex images built up from these simple images. If we consider first John Locke, we find, for example, that memory is taken to consist in the retention of images, that the classification or identification of objects is taken to consist in the checking or comparison of objects and images, and that learning a language is taken to consist in associating sounds and images. Images, in turn, for Locke are mental pictures. He says, speaking of images (or “ideas,” to use his preferred term):

... there is an ability in the mind when it will revive them again, and as it were paint them anew on itself, though some with more, some with less difficulty..."
A little later, he comments:

The ideas of the nurse and mother are well framed in their minds (i.e., the minds of children); and, like pictures of them, represent only those individuals.\textsuperscript{15}

Interestingly, in the following passage, Locke seems to repudiate the pictorial approach to imagery:

To discover the nature of our ideas the better, and to discourse of them intelligibly, it will be convenient to distinguish them as they are ideas or perceptions in our minds, and as they are modifications of matter in the bodies that cause such perception in us; that so we may not think (as perhaps usually is done) that they are exactly the images and resemblances of something inherent in the subject; most of those of sensation being in the mind no more the likeness of something existing without us, than the names that stand for them are the likeness of our ideas, which yet upon hearing they are apt to excite in us.\textsuperscript{16}

It is hard to reconcile Locke's position here with what he says elsewhere (including the two other passages above). Perhaps Locke's underlying intention is to reject the thesis that ideas get their representational content via resemblance while nonetheless holding on to the thesis that ideas are like pictures. If this is what Locke has in mind, then he obviously needs to say much more about just what makes ideas picture-like.

In any event, according to Locke, the ideas or images stored in memory are abstract, as are the ideas used in classification and the ideas that function as word meanings. This claim, that ideas are sometimes abstract, is at bottom the claim that ideas are sometimes sketchy or lacking in detail. Locke's position seems to be that the senses provide us with ideas or percepts that are fully determinate. These ideas are then stripped of some of their internal details as well as the particular circumstances associated with their arrival in the mind. Thus, Locke says:

\[\text{The mind makes the particular ideas received from particular objects to become general; which is done by considering them as they are in the mind such appearances,—separate from all other existences, and the circumstances of real existence, as time, place, or any other concomitant ideas. This is called ABSTRACTION, whereby ideas taken from particular beings become general representatives of all of the same kind;}\textsuperscript{17}\]

It appears, then, that on Locke's view, certain ideas are developed by abstraction from particular ideas received from particular objects. The former ideas are copies of the latter, but the process of copying is such that various details are left out. On this understanding of Locke, his doctrine of abstract ideas is part and parcel of his version of what I earlier called the "weak percept theory."

It seems evident that Locke (and his fellow Empiricists) gave imagery too broad a role in the theater of the mind. For one thing, Locke's assimilation of the sensory to the intellectual ignores the lesson that should have been learned from Descartes' discussion of the chilagon. For another, there are many, many words whose meanings we understand even though we cannot conjure up an appropriate image. Consider, for example, "sake," "conduct," "electron." Moreover, even though images sometimes guide us in linguistic contexts, as Wittgenstein observed,\textsuperscript{18} they cannot always do so. Suppose, for example, that you tell me to form a mental image of a tulip. If acting on a linguistic command requires first framing the appropriate image, then in order to obey you, prior to doing so, I must form a mental image of a tulip. However, that is impossible. As soon as I form the image, I have already obeyed you.

There are passages in George Berkeley's writings that seem to suggest that he appreciated these points about meaning and language. He asserts, for example, that words can be meaningful even when not associated with ideas. However, it is not clear that Berkeley was really opposed to the heart of the Lockean view. For Berkeley can be read as accepting the thesis that if a word is understood by a given person, \(P\), then \(P\) must be capable of producing the relevant idea, even if, upon occasion, \(P\) uses the word without actually associating it with that idea. This interpretation of Berkeley's view fits nicely with the following passage:

\[\text{... a little attention will discover that it is not necessary (even in the strictest reasonings) that significant names which stand for ideas should, every time they are used, excite in the understanding the ideas they are made to stand for.}\textsuperscript{19}\]

There can be no doubt, however, that Berkeley disagrees strongly with Locke on the topic of abstract ideas. Berkeley accepts that mental images and percepts are items of the same type (ideas) and that mental images are frequently generated by combining percepts stored in memory. But Berkeley insists that every idea must have a definite shape and color, that vagueness or indeterminacy has no place in ideas themselves. Just why Berkeley holds this doctrine is not altogether clear. One possible explanation is that Berkeley is wedded to
the received view that mental images are inner pictures. Unlike Locke, however, Berkeley thinks of pictures as we would think of clear photographs. Berkeley holds this photographic view of mental pictures, in turn, because it is dictated, he thinks, by introspection. He says:

[For myself, I find indeed I have a faculty of imagining, or representing to myself, the ideas of those particular things I have perceived, and of variously compounding and dividing them. I can imagine a man with two heads, or the upper parts of a man joined to the body of a horse. I can consider the hand, the eye, the nose, each by itself abstracted or separated from the rest of the body. But then whatever hand or eye I imagine, it must have some particular shape and color. Likewise the idea of a man that I frame to myself must be either of a white, or a black, or a tawny, a straight, or a crooked, a tall, or a low, or a middle-sized man.]

If Berkeley is indeed denying the existence of any less than fully determinate images, then his position seems problematic. For it is surely not difficult to imagine a striped tiger, say, without thereby imagining a definite number of stripes. Likewise, to take the case Berkeley considers above, can one not imagine a man without specifying imaginatively the man's color or size? If one's images are anything like drawn sketches, the answer is obviously yes.

Now Berkeley believes not merely that Locke's doctrine of abstract ideas is inconsistent with the act of introspection but also that Lockean abstract ideas are logically impossible. Consider, for example, the following passage in which Berkeley first quotes Locke and then ridicules his view:

To give the reader a yet clearer view of the nature of abstract ideas and the uses they are thought necessary to, I shall add one more passage out of the Essay on Human Understanding, which is as follows:

Abstract ideas are not so obvious or easy to children or the yet unexercised mind as particular ones. If they seem so to grown men it is only because by constant and familiar use they are made so. For when we nicely reflect upon them, we shall find that general ideas are fictions and contrivances of the mind, that carry difficulty with them, and do not so easily offer themselves as we are apt to imagine. For example, does it not require some pain and skill to form the general idea of a triangle (which is yet none of the most abstract, comprehensive, and difficult); for it must be neither oblique nor rectangle, neither equilateral, equicrural, nor scalenon, but all and none of these at once? In effect, it is something imperfect that cannot exist, an idea wherein some parts of several different and inconsistent ideas are put together.

If any man has the faculty of framing in his mind such an idea of a triangle as is here described, it is in vain to pretend to dispute him out of it, nor will I go about it. All I desire is that the reader would fully and certainly inform himself whether he has such an idea or no. And this, methinks, can be no hard task for anyone to look a little into his own thoughts, and there try whether he has, or can attain to have, an idea that shall correspond with the description that is here given of the general idea of a triangle, which is "neither oblique nor rectangle, neither equilateral, equicrural nor scalenon, but all and none of these at once."}

Although Berkeley certainly has a point here, his rejection of Lockean abstract ideas is, I think, too hasty. For Locke, in the passage Berkeley quotes, seems to have forgotten that his abstract ideas are formed by a copying process that strips percepts of various details and not by a process that adds any properties. Thus, when Locke says that the abstract idea of a triangle must be "neither oblique nor rectangle, neither equilateral, equicrural nor scalenon," in adding "but all and none of these at once," he overstates and confuses his case. What he should have said is simply "none of these at once." Such a statement would have been consistent with the core of the Lockean view, and Berkeley would no longer have been able to charge that Locke's abstract ideas are logically impossible. Admittedly, Berkeley could still argue that ideas cannot be abstract to the degree that Locke supposes. But, to take one example, the case of stick figure drawings shows that pictures—and hence ideas, if ideas are like pictures—can be very sketchy indeed. So Berkeley's attack on Locke, as it stands, is very far from decisive.

The third British Empiricist, David Hume, has views on ideas that are obviously much influenced by Locke and Berkeley. According to Hume, thinking consists in the manipulation of ideas. Understanding a word is a matter of associating the right idea with it. And ideas are the "faint images" of sense impressions. Thus, Hume endorses the assimilation of the sensory to the intellectual, and he also accepts the weak percept theory. Moreover, he relies heavily on what he supposes is demonstrated by introspection. For example, he argues that
the self is nothing but a bundle of different "perceptions" on the grounds that

... when I enter most intimately into what I call myself I always stumble on some particular perception or other, of heat or cold, light or shade, love or hatred, pain or pleasure. I never can catch myself at any time without a perception, and never can observe anything but the perception.23

On the issue of Lockean abstract ideas, Hume sides with Berkeley. In Hume’s view, Berkeley refuted Locke’s theory of abstract ideas. Given that Hume was prepared to grant that some ideas are sketchy, this rejection of Locke’s position is no doubt in part due to Berkeley’s attack on the unfortunate passage from Locke’s Essay quoted earlier. However, Hume is also motivated by a desire to give a plausible account of representational content for ideas. Let me explain.

Suppose I wish to teach you some geometrical point about triangles, though no one triangle in particular. On Locke’s view, when I use the word “triangle,” and you hear me, we both form the abstract idea of a triangle. There are, then, two tokens of the very same abstract idea. But what gives this idea its content? Evidently, it can’t closely resemble any particular triangle. For if it did, it wouldn’t be abstract. Perhaps, then, it gets its content via its interpretation by the person or persons having this idea. But what gives an idea its content is at least in part its interpretation, then no abstract idea is necessary. So long as when I use the word “triangle” I form an idea that I interpret as representing triangles generally and you do likewise, we may understand one another perfectly well even if our ideas in themselves have little in common. Thus, Hume says:

... the image in the mind is only that of a particular object, tho’ the application of it in our reasoning be the same as if it were universal.24

It is important to realize that Hume is not here giving up the picture theory of mental images. Rather, Hume’s insight is that resemblance is not sufficient for pictorial representation, that interpretation must play a crucial role. Kant, incidentally, seems to have shared Hume’s insight in the following passage:

Indeed it is schemata, not images of objects, which underlie our pure sensible concepts. No image could ever be adequate to the concept of a triangle in general. It would never attain that universality of the concept which renders it valid of all triangles, whether right-angled, obtuse-angled, or acute-angled; it would always be limited to a part only of this sphere. The schema of the triangle can exist nowhere but in thought. It is a rule of synthesis of the imagination, in respect to pure figures in space.25

I might add that Hume’s distinction between the claim that something is a picture of an F and the claim that something resembles an F is echoed in the writings of a number of philosophers this century. Nelson Goodman, for example, says:

... unlike representation, resemblance is symmetric: B is as much like A as A is like B, but while a painting may represent the Duke of Wellington, the Duke doesn’t represent the painting. Furthermore, in many cases neither one of a pair of very like objects represents the other: none of the automobiles off an assembly line is a picture of any of the rest; and a man is not normally a representation of another man, even his twin brother. Plainly, resemblance in any degree is no sufficient condition for representation.26

In a somewhat similar vein, Wittgenstein comments:

I see a picture; it represents an old man walking up a steep path leaning on a stick. — How? Might it not have looked just the same if he had been sliding downhill in that position? Perhaps a Martian would describe the picture so. I do not need to explain why we do not describe it so.27

In summary, then, we may say that, by and large, philosophers historically held that mental images are picture-like representations similar to those occurring in perception. They frequently, but not always, allowed these representations to be sketchy or undetailed, and they frequently, but not always, took resemblance to be the picturing relation. They also sometimes exaggerated the role that imagery plays in mental activity generally. In opting for the basic pictorial view of images, they seem to have relied on the evidence allegedly afforded by introspection. And in delineating the boundaries of the realm of imagery, they relied on introspection together with armchair theorizing of one sort or another.

In section 1.2, I turn to a critical examination of these evidential bases for the historical views.

1.2 Critique of the Evidence upon which the Traditional Accounts Rest

Mental images look like the objects that they represent. In this respect, mental images are similar to realistic public pictures and dissimilar
from other public representations, for example, descriptions. Hence, mental images represent in the manner of, or something very like the manner of, real pictures. This is the introspective argument for the pictorial approach to imagery in its simplest form. It has been enormously influential in shaping the views of philosophers historically. And it still has some appeal today. Unfortunately, the argument is badly flawed.

To begin with, the parallel between mental images and pictures is faulty. Although real public pictures do look like the objects that they represent, they do so only if they are viewed under the appropriate perceptual conditions (typically daylight at the distance from the picture intended by the artist for viewing) by perceivers whose perceptual apparatus is functioning normally. Mental images, however, are not viewed by imagers at all. Moreover, if mental images were viewed in daylight by normal perceivers via the use of cerebroscopes—and this, of course, would only be possible if mental images were neural entities, contrary to the claims of most historical philosophers—there is not the slightest reason to think that they would then look like the objects that they represent. After all, the fact that under one set of conditions an object \( O \) looks like another object \( O' \) obviously does not entail that under other quite different conditions \( O \) looks like \( O' \). To take an extreme example, a dot on a blackboard looks like a ship viewed on the horizon but not like a ship a few hundred feet away.

Second, the reason that public pictures look like the objects that they represent when viewed under standard conditions is that in such conditions these pictures have the perceptible qualities they appear to have, and these perceptible qualities—in particular, certain spatial qualities—correspond to those of the represented objects. For example, if parts \( P_1, P_2, \) and \( P_3 \) in a picture represent object parts \( O_1, O_2, \) and \( O_3 \) respectively and \( O_1 \) is below \( O_2 \) and to \( O_3 \)'s left, as the object is seen from a certain point of view, then likewise \( P_1 \) is below \( P_2 \) and to \( P_3 \)'s left, as the picture is seen from a corresponding point of view. This correspondence of various spatial properties seems to be an important element in genuine pictorial representation. But, in the case of mental images, there is no introspective evidence that supports the claim that image parts really have any spatial properties, never mind ones that correspond to spatial properties of the represented objects. Moreover, if, as most historical philosophers supposed, mental images are nonphysical objects in the soul, then obviously mental images lack spatial properties. In this case, then, it follows that there is no spatial correspondence.

Finally, and more importantly, to assert that a mental image of my brother, say, looks to me like my brother is merely to assert that my imagistic experience is like the perceptual experience I undergo when I view my brother with my eyes. The latter assertion says nothing about how my brother is represented in my perceptual experience. He might be represented there pictorially, but equally he might be represented in some other way, for example, in some linguistic manner. Hence, the claim that mental images look like the object they represent leaves open the nature of this representation.26

To the objection that mental images don’t look like words and hence cannot be representing in a linguistic manner, a similar response is appropriate. The claim that a mental image of my brother doesn’t look to me like any public descriptions of my brother is simply the claim that the former imagistic experience isn’t like the perceptual experiences I undergo when I train my eyes on various linguistic tokens representing my brother. Still, this is straightforwardly explicable on the hypothesis that my mental image represents my brother rather than certain words or descriptions for my brother. Thus, my mental image, like the representation involved in my perceptual experience, could be representing my brother linguistically.

Similarly, the fact that mental images are representations that look like pictures to their imagers does not support the picture theory. Imagistic experiences are like the perceptual experiences undergone when viewing the appropriate pictures. This is why mental images look like pictures. But whether the perceptual experiences themselves contain pictorial representations is an open question. And if this is open, so too is the same question for imagistic experiences.

I conclude that philosophers have been much too hasty in their almost universal acceptance prior to this century of the pictorial approach to imagery. If the picture theory rests solely on the testimony of introspection, then it is on very shaky ground indeed.

In the case of the weak percept theory of mental images, it seems to me that introspection is less misleading. Here introspection informs us that imagistic experiences are qualitatively like perceptual experiences although frequently fainter. Thus, introspection does support the claim that imagining is phenomenally rather like perceiving in less than optimal conditions.

The claim that introspection is reliable in this limited context fits well with the results of a famous psychological experiment conducted by C. W. Perky in 1910.29 In this experiment, subjects in a room with normal lighting were asked to face a screen and to imagine a banana on it. Unknown to the subjects, a projector was set up behind the screen, containing a slide of a banana. Once the subjects reported
that they had formed their images, the illumination on the projector was slowly increased so that it eventually cast a picture of a banana on the screen that was clearly visible to any newcomer entering the room. However, none of the subjects ever realized that they were looking at a real picture. Instead, they noticed merely that their “images” changed in certain ways—for example, their orientation—as time passed. This experiment seems to show that imagery is (at least sometimes) experientially indistinguishable from seeing. It thus adds independent weight to the view of the link between imaging and seeing that is presented by everyday introspection.

Turning finally to the role of imagery in mental activity generally, we again find a heavy reliance on introspection together with a priori armchair theorizing in the traditional philosophical accounts. It seems reasonable to hypothesize that one reason why historical philosophers often gave imagery such a prominent role in the mind is that they had no difficulty in finding images when they introspected. Of course, in some cases, images are all that they found (or so they said). Another related reason is that many philosophers subscribed to the view that the mind is wholly transparent to introspection. On this view, the claim that images are the sole mental objects accessible to introspection entails that there are no mental objects other than images.

It seems to me that we have excellent evidence for the falsity of the thesis that the mind is transparent to introspection. If this is indeed the case, if some of the workings of the mind are hidden from conscious view, then the question of the role that imagery plays in cognition generally is evidently not one that could be answered either by introspection directly or by armchair theorizing on the basis of introspection. Rather, it is a question for empirical investigation into the workings of the mind. In short, it is a question for cognitive psychology. I want now briefly to support my claim that the mind is not transparent to introspection. I also want to show how introspection can lead us badly astray when we try to use it in an attempt to discover how given introspectively accessible mental states are causally related.

In a well-known experiment conducted by James Lackner and Merrill Garrett, subjects were told to put on earphones and to listen only to the left channel. In this channel, they heard the target sentence “The officer put out the lantern to signal the attack.” In the other channel, half of the subjects were presented with sentences, the meanings of which clearly fixed the meaning of the target sentence and the ambiguous words “put out,” and the other half were presented with altogether unrelated sentences (e.g., “The flowers have begun to bloom”). The members of both groups reported accurately the contents of the left channel, but no one could report the contents of the right channel. This was not merely because no one listened to the right channel. The sentences in that channel were played at a volume just low enough that no one could have reported accurately what the sentences were even if they had paid careful attention to the sounds coming from that channel.

The subjects were next given tests in which they had to decide on the meaning of the target sentence. Those who had been presented with unrelated sentences in the right channel were split over whether the target sentence meant that the officer placed the lantern outside or that the officer snuffed out the lantern. Those who had been presented with the related sentences (e.g., “The officer extinguished the lantern”) overwhelmingly chose the same, correct interpretation.

The immediate conclusion warranted by this experiment is that the sentences in the unattended channel were understood by the subjects even though they were unable to report consciously on them. The point is not merely that these sentences were acoustically processed. Rather, their meanings were causally relevant to the interpretation the subjects chose, and hence the sentences were semantically processed. The general conclusion to which we are drawn is that at least some of our mental life is inaccessible to consciousness, in other words, that the mind is not wholly transparent to introspection. Of course, Lackner and Garrett’s experiment does not tell us how much of our mental life is unconscious. Perhaps the amount accessible is but a tiny portion. If so, introspection will yield precious little information about our minds. In any event, the degree to which introspection reveals what is going on is to be determined not by a priori reflection but instead by empirical psychology.

Consider now an experiment conducted by Richard Nisbett and Timothy Wilson. People in a shopping mall were asked to examine four identical nylon pantyhose and to rank them according to quality. It was found that the rightmost pantyhose were heavily preferred. On being asked whether position might have been a factor in their decisions, nearly all the people strongly denied it. In this experiment, introspection led people to the view that they formed the belief that the rightmost pantyhose were the best as a result of the visual and tactual sensations they experienced while viewing and handling those pantyhose. But introspection appears to have been badly wrong. Not only is there no reason to suppose that their sensations were any different in this one case than in the others but also what caused their belief was actually a factor they denied to be relevant, namely, the pantyhose position.
Here is another of Nisbett and Wilson's experiments where introspection misleads people about the causal links between mental states. Two groups of subjects were shown filmed interviews with a college professor who had a Belgian accent. The interview seen by one group showed the professor speaking politely in a warm and pleasant manner. The interview seen by the other group showed the professor behaving in an intolerant and aloof manner. Subjects were asked to rate three physical features of the professor that were the same in both films—his mannerisms, accent, and physical appearance—and also to say how likable they found him overall. The first group of subjects liked both the professor and his physical features. The second group disliked the professor, and they found his physical features irritating. Given the invariance across films of the three physical features, these results indicate that the subjects' assessment of the professor's overall likability causally influenced their attitude toward the specific physical features. This causal influence was denied by both groups of subjects, however. Moreover, members of the second group wrongly believed (on the basis of introspection) that their negative attitude toward the professor's three physical features caused their negative assessment of his overall likability (rather than vice versa).

It appears, then, that introspection neither reveals all the mind's contents nor provides reliable information about the causal connections among those mental contents it does reveal. The upshot is that questions about the role that a given kind of mental state (e.g., imagery) plays in the mind as a whole are best answered by empirical investigation into the mind and not by armchair theorizing based upon the fruits of introspection. This is, of course, widely acknowledged today. And, as we shall see later, cognitive psychologists have developed accounts of why we have mental images and the circumstances in which we do and do not use them. Historical philosophers took it upon themselves to develop their own accounts in isolation from any empirical work primarily because they thought that the mind and its workings were illuminated clearly and distinctly by the inner searchlight of introspection. This was a serious mistake, and it left historical accounts of the nature and role of mental imagery without a secure foundation. This is not to say that none of the historical arguments on imagery are sound. As I noted earlier, Descartes's thought experiment involving the chilagon suggests a priori both that imaging is not experientially the same as understanding and that imaging is experientially like seeing. These, it seems to me, are significant points. But they are also very limited in their scope. For nothing is said either about just how imagery relates to under-
Chapter 2
The Decline of the Picture Theory in Philosophy and the Emergence of Alternative Views

The picture theory of mental images has become much less popular in philosophy in recent years. In this chapter, I shall examine the major reasons for its diminishing support, and I shall investigate three important alternative approaches.

The chapter is divided into four sections. In section 2.1, I lay out the contemporary philosophical objections to the picture theory. In sections 2.2, 2.3, and 2.4, I introduce the three opposing theories, offering accounts of why these theories have emerged and what it is that they claim.

2.1 Philosophical Objections to the Picture Theory

Although the picture theory has lost the widespread support it once had in philosophy, it has not been without some notable advocates this century. G. E. Moore, Bertrand Russell, and H. H. Price, for example, all held that seeing the external world involves the apprehension of inner picture-like impressions, or “sense-data,” as they are often called. These sense-data are held to occur not only in veridical perception but also in hallucinations (as, for example, in the case of Macbeth when he said, “Is this a dagger which I see before me, / The handle toward my hand? Come let me clutch thee. / I have thee not, and yet I see thee still”). Moreover, sense-data can be conjured up by deliberate acts of the imagination, according to their advocates. Thus, the sense-data of the twentieth century are none other than the ideas and impressions of Locke, Berkeley, and Hume.

The sense-datum theory of visual perception and the parallel picture theory of mental imagery have come under severe attack, however, in the latter half of this century. Let us begin with some objections to the picture theory that are to be found in the work of Gilbert Ryle. In The Concept of Mind, Ryle argues that neither imagination nor seeing involves any inner mental pictures of which the subject is aware. In the case of imagination, Ryle claims that we think
that there are mental pictures because the ordinary ways we speak naturally suggest such a view. For example, we talk in everyday contexts of picturing objects when we imagine them. This naturally leads philosophers to suppose that there are mental entities corresponding to this talk. But the thesis that mental images are inner pictures is really very puzzling. Evidently, mental images are not viewed with real eyes. They cannot be placed in real frames. There is no genuine canvas or paint. Thus, philosophers have been led to the view that mental images are picture counterparts that are viewed with a mind’s eye and that are located not in real space but instead in some ghostly realm. This is all a mistake, according to Ryle, fostered by the propensity of many philosophers to take ordinary language too literally. And it is certainly no less puzzling than the unhedged view that mental images are real pictures. For what is a mind’s eye? Or a picture counterpart? And what is the connection between ghostly “space” and real space? Moreover, if, as adherents of the picture theory generally suppose, seeing the external world, like imaging, involves an inner “eye” seeing an inner “picture,” then won’t this latter seeing itself require a further inner “picture” and a further “eye” that sees it, and so on ad infinitum?

This objection evidently has substantial force. It seems to me, however, that Ryle is not obviously correct in his assertion that it is ordinary language that generates the picture view. For none of the historical philosophers actually cite linguistic usage as a reason for adopting the picture theory. Instead, they typically focus on the evidence afforded by introspection. Moreover, one possible account of why our ordinary talk of mental imagery seems to support the pictorial view is that introspection has led not only philosophers but also nonphilosophers to adopt that view and to enshrine it in our ordinary language. Still, it cannot be denied that the claim that mental images are inner pictures is very perplexing. And philosophers who made this claim said little to explain it. Admittedly, as we saw in chapter 1, most advocates of the picture theory held that mental images copy or resemble what they represent. But this is really not very helpful, for everything resembles everything in some respect or other. Nor does it improve matters to say that mental images closely resemble the objects that they represent, for it is far from clear what could ground such a close resemblance.

Another of Ryle’s objections to the picture theory of mental images is also offered as an objection to the weak percept theory. This objection has been less influential than the one above, and it seems to me much less powerful. Ryle argues that mental images are not just played-back copies of original sensations, that mental images derive their representational content (at least in part) from how they are interpreted by their subjects. According to Ryle, if I vividly “see” something in my mind’s eye, I must be able to identify what I “see.” By contrast, if I peer at an object in the distance using my real eyes, I may not be able to say just what I see. This shows, Ryle claims, that imaging isn’t like seeing and also that imaging isn’t like observing a picture. For just as one might be unable to identify an object in the distance, so too one might be unable to identify what a given real picture pictures (e.g., whether it portrays Tom Smith or his identical twin, Tim).

Ryle’s initial point—that interpretation plays an essential role in determining imagistic content—is one that at least some of the historical picture theorists granted. Hume, for example, seems to have appreciated this point. Ryle’s second claim, however, is contentious. Contra Ryle, surely it is possible to “see” something in one’s mind’s eye and yet fail to identify it. Suppose, for example, that I show you an object but you are unable to tell exactly what it is that you are seeing. Still, you can form a mental image of that very object. In this respect, having a mental image of one particular, real object is just like seeing that object. And, in this respect, a mental image itself need not come stamped with the correct identification of the kind of object imaged even if it is always associated with some interpretation, for example, as being an image of the object so-and-so is holding.

Here is another example. Suppose I get you to view an ambiguous figure and then form a mental image of it. Initially, when you inspect your image, you may not be able to identify at all what the figure pictures. A little later, you may suddenly realize that your image is an image of a figure representing a duck. Perhaps later still, you “see” the alternative: your image is also an image of a figure representing a rabbit. Where Ryle goes wrong, I suggest, is in ignoring the distinction between having a mental image of one specific object (in which case, there must really be an object in the world which one is imaging) and having a mental image of an object of kind F (though no one object of kind F in particular). In the latter case, it seems plausible to hold that one must identify what is imaged as being an F. In the former case, however, there need be no such identification. What is true here for imaging is true also for seeing, it seems to me. The analogy to the latter case is seeing that there is an F, the analogy to the former is seeing an F.

A third objection of Ryle’s is that the familiar comparison of seen things and their likenesses (e.g., trees and their reflections or their photographs) makes it easy and tempting to describe visual imaging as if it involved looking at a likeness instead of the original. But such
an approach, Ryle claims, is entirely implausible for images associated with smell and taste. Suppose, to take Ryle's example, I vividly "see" in my mind's eye the blacksmith's forge I used to visit in my youth and I "smell" a singed hoof. Ordinary English doesn't permit me to say, "I smell a copy of a singed hoof." Indeed, the very idea of a distinction between a smell and a copy of a smell is nonsensical. Hence, just as we should reject the "copy" or likeness view for images of smell and taste, so too we should reject that view for visual images.

It seems to me that this conclusion is much too hasty. Even if Ryle is correct in saying that no copy or picture account is appropriate for imaging smells, it obviously does not follow from this that visual imagination does not involve any copy or picture. The need for semantic uniformity in the treatment of statements about visual imagination on the one hand and imagination of smell and taste on the other could be met by holding that all such statements assert that the relevant persons are undergoing experiences much like those normal perceivers undergo in seeing, smelling, or tasting the relevant objects (whichever is appropriate). But there is surely no requirement that the representations involved in such experiences always be of the same type. That is a matter to be settled not by armchair reflection but rather by empirical investigation. It may turn out that smell representations are in certain respects like visual representations. But whether this is so and what these respects are is something our ordinary concepts leave open.

A further objection to the picture theory is that it cannot accommodate the vagueness or indeterminacy of many mental images. This objection has been enormously influential. It has been raised not just against the picture theory of images but also in parallel form against the sense-datum theory of visual perception. In one of its forms, the objection is simply that people sometimes have mental images or percepts that leave various details out. For example, as I noted in chapter 1, a person might have a mental image (or a visual percept) of a tiger and yet be unable to specify how many stripes the imaged tiger has. This, it is alleged, would not be possible if mental images (or visual percepts) were pictorial.

The obvious response to the above objection is to point out that ordinary pictures (e.g., blurred photographs) are sometimes vague or unclear. However, this response will not refute the more sophisticated versions of the objection. Consider, for example, the views of Daniel Dennett. Unlike many proponents of the objection from indeterminacy, Dennett acknowledges that pictures can sometimes be fuzzy. However, according to Dennett, for any visual property \( P \), you can look at what is pictured by any given picture and determine whether or not \( P \) is present, unless the relevant portion of the picture is vague or unclear. Dennett maintains that this is not so for mental images. Suppose, for example, I tell you to imagine a woman wearing a red dress. If I then ask you such questions as "Is your imaged woman carrying a handbag?", "What color are her shoes?", and "Does her dress extend below her knees?", you may not be able to say. The problem is not that the relevant portions of your image are obscured. Rather, in Dennett's view, your mental image simply doesn't go into some of the details.

The general point of Dennett's objection, then, can be put in the following way. Imagining, unlike picturing, is subject to a fourfold distinction: it's one thing to imagine an object with visual property \( P \); it's another to imagine that object without \( P \); it's a third to imagine the object with the relevant portion so obscured that one cannot tell whether \( P \) is present; and it's a fourth to imagine the object without one's image going into the presence or absence of \( P \). By contrast, in the case of picturing, only the first three distinctions are applicable—the fourth is not.

We shall return to this form of the objection from indeterminacy in section 2.3 (and also in chapter 6). For the moment, I want to move on to another, quite different objection to (one version of) the picture theory. This objection—the last I shall mention—has again been highly influential. In its simplest version, it is directed against any theory of mental images that takes images to be physical particulars. Suppose I form a green image. This green image cannot be a physical object, for nothing inside my head is colored green. Nor need there be any green physical object in my immediate environment. Thus, insofar as proponents of the picture theory of images posit physical pictures, they are making a serious mistake. Sometimes this objection is extended further to any theory that takes mental images to be objects, physical or nonphysical. For just as nothing inside my head is colored green, so too, it is sometimes suggested, nothing inside my soul (if I have one) could really be colored green either. Hence, there aren't any mental images at all. Instead, there are merely persons who image in various ways or, alternatively, various acts of imaging.

The above objection was first made by J. J. C. Smart in his famous paper, "Sensations and Brain Processes." The conclusion Smart drew, in his defense of the mind-brain identity theory, was that mental images do not exist. I should add that Smart did not argue against the view that mental images are nonphysical particulars in the manner described above. Rather, he was concerned to show that
materialism with respect to sensations and imagery is compatible
with the ordinary belief that statements like

(1) Smith has a green afterimage

are sometimes true. In Smart's view, (1) is to be analyzed as

(1a) Smith undergoes a visual experience much like the experi-
   ence he would undergo were he to see a green physical object,
and (1a), in order to be true, does not require the existence of a
green image. Hence, materialism is safe.

Is this objection from color successful? I think not. One who wishes
to defend the view that mental images are physical particulars can
argue that in predicating color words of images, we are doing one
of two things: either we are using these words elliptically for expres-
sions like "represents (real, objective) green," "represents (real, ob-
jective) blue," and so on, or we are using them to name intrinsic,
phenomenal properties different from (real, objective) color prop-
erties. In the former case, there is no difficulty for the view that a
green mental image is a neural entity, say, since a neural entity can
certainly have some neural quality in virtue of which it represents
green. In the latter case, again there is no difficulty for the same
view, since no argument has been given that neural entities cannot
have phenomenal properties. Of course, there are well-known arg-
ments in the literature against the view that phenomenal prop-
erties are physical properties. But even if these arguments were sound,
there would still be no compelling objection to the view that mental
images are physical particulars, that is, particulars that have physical
descriptions. For such particulars could still have some nonphysical
properties in addition to their physical ones.

One other point must be addressed in connection with the objec-
tion from color: if color words express intrinsic, phenomenal qualities
in application to mental images, as is suggested on one of the two alter-
atives proposed above, then why are these words used? If phenomenal
green isn't real green, then why is it called "green" at all? The answer, I suggest (if color words do indeed sometimes express intrinsic, phenomenal qualities),
is that in using color termin-
ology, we are making a conceptual connection between certain
phenomenal qualities and certain colors. Phenomenal green, for ex-
ample, on one version of this view, is conceived of as the phenomenal
quality that is typically caused in normal perceivers by the presence
of a green physical object before the eyes. This claim is similar to the
one Smart makes in holding that (1) is equivalent to (1a). But there
is an important difference (other than the introduction of causal
termology): on the above proposal, there is no denial of the existence
of mental images. Thus, (1), for example, is to be taken to assert that there is an afterimage that Smith has, and this afterimage
has the phenomenal quality typically produced in normal perceivers
by viewing green physical objects. The conclusion I draw, then, is that
Smart did not need to deny the existence of mental images (or
sensory objects generally) in order to save materialism with respect to
imagery and sensations.

We have now examined the major twentieth-century philosophical
objections to the picture theory of mental images. Some of these
objections have been answered; others have been left for a more
detailed study in subsequent chapters. In section 2.2, I begin my
discussion of the three alternative accounts of imagery that have
emerged in philosophy this century.

2.2 The Behaviorist View of Imagery

The first alternative to the picture theory that I want to introduce is
the behaviorist view of imagery, which began in psychology with J.
B. Watson.11 In Watson's view, mental images are one variety of
subvocal thinking. They involve no more than slight movements of
the larynx. When one forms a mental image, one is in essence talking
to oneself under one's breath. Watson says, for example:

What then becomes of images? ... What does a person mean
when he closes his eyes or ears (figuratively speaking) and says,
"I see the house where I was born, the trundle bed in my
mother's room where I used to sleep—I can even see my mother
as she comes to tuck me in and I can even hear her voice as she
softly says good-night?" Touching, of course, but sheer bunk.
We are merely dramatizing. The behaviorist finds no proof of
imagery in all this. We have put all these things in words long,
long ago and we constantly rehearse those scenes verbally when-
ever the occasion arises ... What we mean by being conscious
of events which happened in our past is that we can carry on a
conversation about them either to ourselves (thought) or with
someone else (talk).12

In this passage, Watson is not denying the existence of imagery
altogether. His point is that people's introspective reports do not
demonstrate that there are inner mental pictures. Such reports, in
Watson's view, merely express opinions, and the opinions they ex-
press are badly mistaken. Mental images are really just inner speech.
2.3 Philosophical Descriptionalism

The second alternative to the picture theory in twentieth-century philosophy is a view commonly known as descriptionalism. This view can be traced back before this century to the passage quoted in Chapter 1 from Locke's *Essay Concerning Human Understanding* in which Locke compares the relation between an image and its object to that between a word and what it represents.\(^{14}\) The view also has some similarity with Watson's claim that imaging is talking to oneself.

The basic thesis of descriptionalism is that mental images represent objects in the manner of linguistic descriptions.\(^{15}\) This thesis should not be taken to imply that during imagery, inner tokens of the image's spoken language must be present either in the imager's brain or in any movements of the imager's larynx. Rather, the thought is that mental images are neural entities that represent objects in some neural code that is, in important respects, language-like.\(^{16}\)

Descriptionalism remains popular in philosophy today, and it also has significant support in contemporary psychology.\(^{17}\) In Chapter 4, we shall investigate the empirical data that, some psychologists claim, offer strong evidence for descriptionalism. In the present context, my concern is solely with the philosophical underpinnings of the view.

Several factors have influenced the growth of descriptionalism. To begin with, there has been a dissatisfaction with the traditional philosophical reasons for the picture theory and in particular with the appeal to introspection. Descriptionalists would urge, as I did in Chapter 1, that all introspection really shows is that having a mental image is experientially rather like seeing. Thus, the question of how objects are represented in mental images (and visual percepts) is left entirely open by the introspective evidence. A second factor in the growth of descriptionalism has been the belief that at least some of the objections canvassed in Section 2.1 present insuperable difficulties for the picture theory. A third, and related, factor has been the view that these objections not only present no difficulties for descriptionalism but, in one case at least, actually offer strong support for it. The case I have in mind is that of the objection from indeterminacy. Since descriptions frequently leave things unspecified—I may say, for example, that a tiger is approaching or that a man knocked on the door without specifying the number of the tiger's stripes or the presence of a hat on the man's head—it follows that if mental images represent in a descriptional manner, then they too will frequently be representationally indeterminate. This point has been made forcefully by J. M. Shorter\(^{18}\) and also by Daniel Dennett.\(^{19}\) The latter has
argued further that describing is subject to the same fourfold distinction as imagining. Recall that with respect to imagining, Dennett notes that it is one thing to imagine an object X with visual property P, another to imagine X without P, a third to imagine X with the relevant portion so obscured that one cannot tell whether P is present; and a fourth to imagine X without one’s image going into the presence or absence of P. Analogously, it is one thing to say, “X has P’; another to say, “X lacks P’; a third to say, “X is before me but I cannot tell whether X has P,” and a fourth to say simply, “X is before me.”

It is perhaps worth noting here that there is a worthwhile objection to the view of some descriptionists that descriptionism does not face any of the standard philosophical puzzles raised in connection with the picture theory at the beginning of section 2.1. If inner pictures require inner eyes to “see” them, so presumably inner descriptions require inner eyes to “read” them. And if descriptions are to be manipulated or altered, then inner hands, scissors, and glue seem necessary also.

It seems to me that the correct descriptionist response to this argument is to point out that since digital computers “read” and manipulate inner descriptive tokens without “eyes” or “hands” there is no reason to think that we cannot do likewise. In the case of the computer, an account may be given of how it performs a given operation (e.g., multiplication of two numbers) by decomposing it into simpler operations (e.g., addition) repeated an appropriate number of times, until such simple operations are reached that they can only be explained by reference to the hardware of the computer. It is at this level that the software and hardware explanations of the performance of operations come together. What is true here for digital computers is true also for our manipulation of inner descriptive representations, or so the descriptionist can urge: just as the digital computer handles descriptive representations mechanistically—that is, via mechanisms whose only explanation ultimately is in terms of the computer’s hardware (e.g., in terms of electronics)—so too we handle inner representations of the same sort in a corresponding mechanistic manner. Eyes, hands, scissors are not required.20

A final factor influencing philosophical descriptionists has been a desire for theoretical unity.21 Since memory, belief, desire, and other propositional psychological attitudes are best viewed as being relations to inner sentence tokens, or so many philosophers suppose,22 a linguistic account of mental images and their representational content yields a more unified approach to the mind overall than does the picture theory.

2.4 The Adverbial Theory and Eliminativism

Let us turn now to the third and last alternative to the picture theory in twentieth-century philosophy. This alternative has two variants, one of which is much more extreme than the other. What unites these two variants is the shared view that there are no mental images. In the case of the less extreme variant, the supporting reasons typically run along the following lines: grammatically, a statement such as

(2) Mary has an image of a red triangle

is on a par with a statement such as

(3) Mary has a red dress.

This grammatical similarity between (2) and (3) suggests a logical similarity too. Thus, just as (3) is to be analyzed as

(3a) There is an object x such that x is a red dress and Mary has x,

so, it is tempting to infer, (2) is to be analyzed as

(2a) There is an object x such that x is an image of a red triangle and Mary has x.

But (2a) generates a whole host of problems and puzzles. Some of these puzzles we have already met in our discussion of objections to the picture theory. And there are others of a more general nature. For example, can there be unowned images (like unowned dresses)? Can two persons have one and the same image (as two persons could jointly own a single dress)? Do mental images have rear surfaces that imagers aren’t aware of? If mental images are nonphysical objects, then how did they emerge in the evolution of matter?

What these puzzles suggest is that philosophers, in analyzing (2) as (2a), have been misled by the grammar of ordinary language. Grammatical form is not always a good indicator of logical form. Consider for example, the statement

(4) The average British family has 1.3 children.

The grammatical subject of (4) is “the average British family”; but the logical subject is the number, 1.3, and what (4) really says is that this number is the result of dividing the number of British children by the number of British families. (4), then, does not have the same logical form as (2). Rather, (2) is to be understood in the same general way as
(5) Mary has a noticeable stutter.

In (5), the term “stutter” is a verbal noun. Upon its conversion to a
verb, its adjectives become adverbs. Thus, (5) may be rewritten as

(5a) Mary stutters noticeably.

Similarly, (2) is to be analyzed as

(2b) Mary images a-red-triangle-ly.

Of course, (2b) does not yet give us the full logical form of (2). On
some accounts, (2b) is analyzed further so as to bring out an ontic
commitment to an event of imaging in a certain way, namely, a-red-
triangle-ly. On other accounts, (2b) is given a semantics in which
“Mary” names Mary, “images” expresses the property of imaging,
and “a-red-triangle-ly” is a predicate operator, which, in application
to “images,” forms another predicate. However the semantic analy-
ses are developed, what is common to these adverbial approaches to
imagery is a repudiation of mental images as genuine objects together
with an acceptance of the truth of many ordinary, everyday image
statements.23

This view of imagery, and of sensory experience generally, remains
very popular in philosophical circles. Versions of the view are to be
found in the writings of, for example, R. M. Chisholm, Wilfrid Sel-
lars, Bruce Aune, and myself.24 Despite its widespread acceptance,
prior to my own publications on the adverbial theory, very little had
been said about the semantic and metaphysical foundations of the
view. And it is absolutely essential that the semantics and meta-
physics be stated clearly. For in the absence of such statements, the
adverbial theory may look like a rather trivial grammatical transfor-
mation without any real constraints.

The adverbial theory of mental images is not without potential
difficulties of its own, however, even putting aside this last point.
For if it can be shown that ultimately there are clear answers to the
(at least initially) puzzling questions faced by theories that take men-
tal images as genuine objects, then there is no immediate reason not
to take the grammatical form of image discourse at its face value, in
which case the adverbial theory appears to lose one of its major
motivations. A second potential difficulty concerns the account that
is to be given of representational content. Mental images represent
objects. An image of a red triangle is an image that represents a red
triangle. How are these facts to be analyzed from an adverbialist
perspective? If there are no imagistic representations, then just what
has representational content? Further, how is the adverbial approach
to be reconciled with work in cognitive psychology on imagery, work
that appears to take mental images as objects in their own right?25

I come finally to the extreme version of the view that mental images
do not exist. This is the eliminativist account favored most notably
by Richard Rorty and Paul Churchland.26 According to eliminativism,
the ordinary psychological statements we make from day to day are
no more to be trusted than the statements our predecessors made
“about” witches, caloric fluid, and phlogiston. Radical error infects
the former talk just as it does the latter. Thus, mental events and
mental objects generally do not exist, according to the eliminativists,
for the simple reason that the everyday statements of our folk psy-
chology are, one and all, false.

What seems to motivate eliminativists is the desire to defend a
general materialism together with the belief that any attempt to find
neural entities with which to identify mental states at either the token
or the type level is fundamentally misguided. In the view of elimi-
native materialists, psychological discourse has commitments that
there is not the slightest reason to think will mesh neatly with our
neural hardware.

This version of materialism is very difficult to swallow. One stan-
dard objection that carries significant weight with many philosophers
is this: if folk psychology is, as a matter of fact, not true, then why
does it work so well? Consider, for example, explanations of behavior
via beliefs and desires. There can be no denying that the attribution
of the appropriate beliefs and desires frequently leads to substanti-
ated behavioral predictions. Why? What accounts for the widespread
success of belief-desire psychology? After all, in general isn’t predic-
tive success evidence for the truth of a theory, particularly when that
theory is without competitors in its own area? Eliminative materialists
such as Rorty and Churchland have not satisfactorily answered these
questions. Instead, they have focused on what they take to be the
“stagnancy” of folk psychology. Their view is that folk psychology
is a bad theory without any successes worth explaining. This strikes
many philosophers (myself included) as a decidedly skewed descrip-
tion of the facts.

Another difficulty for eliminativism is the success of theoretical
cognitive psychology. Cognitive psychologists are primarily inter-
ested in answering “how” questions pertaining to the exercise of our
cognitive capacities. They try to explain how we remember, how we
understand, how we image, how we perceive, and so on. If none of
these cognitive capacities really exist, then it is very difficult to grasp
what it is that these psychologists are doing and why it is that at
least some of their theories seem to have been so successful.
In conclusion, then, it seems accurate to say that the picture theory of images has lost support among philosophers in part because of its uncritical reliance on introspection and in part because it is plagued by a whole host of objections, several of which are widely considered decisive. Of the alternative views that have emerged to fill the gap left by the repudiation of the picture theory, the adverbial theory and descriptionalism are the most popular, although eliminativism also has some present-day support.

Chapter 3

The Picture Theory in Cognitive Psychology

Despite its unpopularity in contemporary philosophy, the picture theory has become a subject of intense debate in recent cognitive psychology. Some cognitive psychologists, notably Stephen Kosslyn, have argued that the best explanation of a variety of experiments on mental imagery is that mental images are pictorial. Although Kosslyn has valiantly tried to explain just what the basic thesis of the pictorial approach, as he accepts it, amounts to (and he has certainly said much more on this topic than any philosopher), his position remains difficult to grasp. As a result, I believe, it has been badly misunderstood both by prominent philosophers and by prominent cognitive scientists. This seems to me especially unfortunate, since, in my view, Kosslyn's work, once properly elucidated, breathes new life into the moribund body of the picture theory.

The structure of this chapter is as follows. In section 3.1, I present a clear statement of the central thesis of the picture theory, as it is understood by Kosslyn, the foremost contemporary advocate of the theory. I also bring out one alternative way in which the picture theory may be elucidated. In section 3.2, I discuss whether there is really any conflict between the pictorial view of mental images and the digital computer model of the mind, as has been claimed by Ned Block and by Hubert and Stuart Dreyfus, among others. In section 3.3, I briefly summarize the experimental data that allegedly support the picture theory and I show just how the theory explains the data. Finally, in section 3.4, I make some remarks on what imagery is good for from the perspective of the picture theory.

3.1 Kosslyn's Version of the Picture Theory

What can it mean to say that mental images are pictorial? This is no easy question to answer. As I noted earlier, mental images are not really seen. They cannot be hung on real walls. They have no objective weight or color. Moreover, the fact that mental images look like
the objects they represent offers no support for the picture theory. Stephen Kosslyn’s preliminary response is to propose that mental images are to be conceived of on the model of displays on a cathode ray tube screen attached to a computer. Such displays are generated on the screen by the computer from information that is stored in the computer’s memory.

This model, primitive though it is, is superior to certain other pictorialist models. For example, consider the suggestion that mental images are like slides or photographs that are stored in memory and are taken out whenever the experience of imagery occurs. It is evident that this model cannot explain our ability to imagine entirely novel scenes or our ability to add to or alter features of images.

Neither of the above abilities is problematic if we think of images as being like displays on a computer monitor screen, since such displays are generated rather than retrieved and they can easily be added to or altered by manipulating the information stored in the computer’s memory. But there are obvious differences between mental images and screen displays. So just what are the respects in which the former are supposed to be like the latter?

Kosslyn suggests that before we answer this question, we reflect upon how a picture is formed on a monitor screen and what makes it pictorial. We may think of the screen itself as being covered by a matrix in which there are a large number of tiny squares or cells. The pattern formed by placing dots in these cells is pictorial, Kosslyn asserts, because it has spatial features that correspond to spatial features of the represented object. In particular, dots in the matrix represent points on the surface of the object, and relative distance and geometrical relations among dots match the same relations among object points. Thus, if dots A, B, and C in the matrix stand respectively for points P₁, P₂, and P₃ on the object surface, then if P₁ is below P₂ and to P₃’s left (as the object is seen from a particular point of view), then likewise A is below B and to C’s left (as the screen is seen from a corresponding point of view). Similarly, if P₁ is farther from P₂ than from P₃, then A is farther from B than from C.

It is perhaps worth noting that this last claim needs qualification if it is to be generally applicable. For P₁ may be farther from P₂ than from P₃ on the object surface and yet appear to be closer to P₂ within the context of the relevant point of view. It would be more accurate to say, then, that if P₁ appears farther from P₂ than from P₃ (relative to the relevant point of view), then A is farther from B than from C.

Kosslyn’s reasoning now becomes more opaque. The main strand of thought in Kosslyn’s writings seems to be that although mental images lack the above spatial characteristics, they nonetheless function as if they had those characteristics. Thus, in Kosslyn’s view, it is not literally true that mental images are pictures. Rather, the truth in the picture theory is that mental images are functional pictures.

But just what is involved in something’s being a functional picture (or a “quasi-picture,” as Kosslyn sometimes says)? Kosslyn’s discussion of this pressing question is not easy to follow. In Ghosts in the Mind’s Machine, Kosslyn presents an example to illustrate what he has in mind. Here is the example (with minor modifications). Suppose a cross figure is drawn in a 7 × 7 matrix as in figure 3.1. Suppose now that 49 different people are each shown figure 3.1 and are each told to memorize whether a given square is filled, with different squares being assigned to different people. The information that is in figure 3.1 is now also stored in the group of 49 people. If you later meet this group of people and ask whether square (1,1) is filled, whether square (1,2) is filled, and so on through the whole matrix, you can reconstruct from their responses—either the single word "filled" or silence—what is pictured in figure 3.1. This group of people—or more precisely their collective positive responses—forms a functional picture, according to Kosslyn. He says:

Even though the people may be standing anywhere, they [can] function to represent points that are close together in the matrix, diagonal, and so on. All the information in the picture is available, even though there is no actual picture.

It is, I think, evident that this example does not really clarify what makes something a functional picture and hence that Kosslyn’s pic-
tue theory remains obscure. I want now to try to remove this ob-
scurity. Later I shall return to Kosslyn's example, and I shall show
why the positive replies of the group of people form a functional
picture, as Kosslyn asserts.

According to Kosslyn, spatial structure plays a central role in pic-
torial representation. To arrive at a significant thesis, I suggest that
Kosslyn needs some way of exploiting this view without thereby
being forced into the extreme position that mental images are gen-

realistic pictures.

It seems to me that one possible model in this context is presented
by the retinotopic representations found on the visual cortex in visual
perception. These retinotopic representations reconstruct the retinal
image in the cortex. However, the retinal surface is not reconstructed
in a linear manner. Rather, the image is distorted as if it had been
printed on a sheet of rubber, which had then been irregularly
stretched. Consider, then, the case of a pictorial pattern of a single
object $O$ imprinted on rubber. After the rubber has been stretched in
all directions in varying degrees, many of the pattern's internal spa-
tial relations (for example, its components' relative distance relations)
will change dramatically, and the pattern as a whole will no longer
be a realistic picture. Nonetheless, any path drawn on the rubber
prior to stretching and divided into segments retains the same num-
ber of segments after stretching even though their lengths change.
Moreover, both before and after stretching, every part of the rubber
that represents anything represents a part of the represented object
$O$.

Reflection upon these facts suggests to me a general analysis of
quasi-picturing along the following lines:

A representation $R$ is a quasi-picture of an object $O$ as seen from
point of view $V$ if, and only if, (i) every part of $R$ that represents
anything represents a part of $O$ visible from $V$; (ii) a sufficient
number of apparent relative surface distance relationships among
parts of $O$ visible from $V$ are represented in $R$; (iii) for
any three represented $O$ parts, $X$, $Y$, and $Z$, if $X$ appears at a
greater surface distance from $Y$ than from $Z$, then this fact is
represented in $R$ if and only if there are more $R$ parts represent-
ing apparently adjacent $O$ parts that are connected by the short-
est apparent path on the surface of $O$ between $X$ and $Y$ and that
are each of the same apparent length $L$ as measured along that
path than there are $R$ parts representing the corresponding $O$
parts of apparent length $L$ between $X$ and $Z$.²³

Some comments are necessary on this proposal: (1) Insofar as an
analysis is being offered, it is an analysis of what makes a given
representation (of $O$) quasi-pictorial and not an analysis of what makes
something a quasi-pictorial representation (of $O$). Thus, although my
proposal uses the concept of representation, there is no circularity
resulting from this usage. In this chapter, I shall have nothing to say
about the concept of representation in general. (2) Condition (i) is
included in the analysis on the assumption that $R$ is a quasi-picture
of $O$ and of no other object that is not an undetached part of $O$. If $R$
is a quasi-picture of $O$ together with certain other objects (that are
not parts of $O$), condition (i) will be too strong and should be replaced
by the following condition: The part of $R$ that represents $O$ has
representational parts, each of which represents a part of $O$ visible
from $V$. (3) In those cases where a representation $R$ meets the three
stated conditions without the restrictions about point of view and
appearance, $R$ may be said to be a quasi-picture of $O$ without adding
the qualification "as seen from point of view $V." (4) If we want to
say that quasi-picturing admits of degrees so that some representa-
tions are very minimal quasi-pictures whereas others are strongly
quasi-pictorial, we will need to replace the phrase "a sufficient num-
ber" in (ii) by some such term as "few" or "numerous," whichever
is appropriate to the given degree of quasi-picturing. (5) The stated
analysis applies to the case of quasi-pictorial representation of one
given object. It is not intended to cover what it is for a representation
to be a quasi-picture of an object of type $F$ (though no one object of
that type in particular). (6) The notion of part at work in the analysis
requests some comment. It seems to me that there is good reason to
deny that either $O$ parts or $R$ parts must be natural. To see this,
consider a skeletal map of the United States. Suppose that on this
map there is a dot representing Chicago, a dot representing Los
Angeles, and a dot representing New York, and that nothing other
than the United States boundaries is marked. Would this map be a
quasi-picture of the United States? If the representational parts of the
map are taken to be bits of ink spatially located within its perimeter,
then the answer is no, for greater distances among parts of the United
States represented by dots (i.e., cities) are nowhere represented via
greater numbers of dots. However, if the representational parts are
taken to include arbitrary unmarked regions within the map's perim-
ter, then the answer is yes. Let me explain.

The only cities represented on the map are Chicago, Los Angeles,
and New York. Nonetheless, it seems reasonable to say that other
parts of the United States are also represented, if $O$ parts and $R$ parts
can be arbitrary as well as natural. For example, the western half of
the United States is represented by the left half of the map (within the boundary lines); the lower third of the United States is represented by the lower third of the map; and so on. Imagine now a straight path drawn between the dot representing Chicago and the dot representing Los Angeles. Imagine further that this path is arbitrarily divided into four segments, each of the same length (one inch, say). Then it seems reasonable to hold that the region of the map making up the first such segment connected to the dot representing Chicago represents a region of the United States that ends at Chicago and that has a certain length (500 miles, say) and a certain breadth (appropriate to the width of the imaginary path). The second segment represents an adjacent region of the same size. Similarly the third and fourth. Since there will be more of these one-inch segments between the dots representing Chicago and Los Angeles than between the dots representing Chicago and New York, the fact that Chicago is farther from Los Angeles than from New York will be represented in the map in the manner required by condition (iii) (ignoring the irrelevant qualifications about appearance and points of view). And many other relative distance relations between arbitrary parts of the United States or its boundaries will also be similarly represented. The map will therefore count as a quasi-picture, according to the stated proposal. What makes the map described above different from most quasi-pictures is the fact that the parts of it that represent adjacent parts of the same size are themselves physically adjacent and also of the same size so that greater distances among parts of the represented entity (in this case the United States) are represented via greater distances on the representation. As I noted earlier, this feature is found in genuine realistic pictures (given the qualification I stated). But it is certainly not required for quasi-pictures, as defined above.

My suggestion, then, is that we should permit the term “part” in my account to apply to both arbitrary and natural parts. Now not all parts of a representation $R$ need be representational any more than all parts of the object $O$ need be represented. Two questions may thus be distinguished: “What makes a given $R$ part (or any entity for that matter) representational?” and “What makes a given $R$ part a part of $R$?” Though I shall have nothing to say on the general concept of representation in this chapter, I do want to make some brief remarks in response to the second question. It seems to me that a very natural requirement to impose on $R$ parts is that they be spatially within $R$ as a whole. Such an interpretation of “$R$ part” rules out the possibility that mental images are nonphysical quasi-pictures and indeed that there are any nonphysical quasi-pictures at all. However, this consequence is one that few philosophers or psychologists would find unpalatable. Moreover, the above interpretation does not place severe restrictions on the physical realization of mental images, for it does not preclude quasi-pictures from having widely scattered parts. Still, it does entail that every $R$ part be assigned a smaller region in space than $R$ or any part of $R$ of which it is a part. And some pictorialists may want to argue that even this consequence is too strong, that further latitude is desirable in the physical realization of mental images on the pictorialist hypothesis. Likewise, some descriptionists may want to deny that their talk of representational parts commits them to the view that such parts must be spatially within the representations of which they are parts. Anyone who takes this line must show that it makes sense to suppose that the parts of a representation include abstract functional parts that are not necessarily spatial parts. If this can be done, then my talk of $R$ parts need not be tied to a spatial interpretation of the term “part.”

Now the proposal we have arrived at not only has some continuity with Kosslyn’s view of the way in which a display on a monitor screen is genuinely pictorial but also unifies and sharpens a number of other statements that Kosslyn makes, statements such as the following:

The primary characteristic of representations in this format [that is, quasi-pictures] is that every portion of the representation must correspond to a portion of the object such that the relative interpolation distances on the object are preserved by the distances among the corresponding portions of the representation.

Importantly, distance in the medium [of quasi-pictorial representation] can be defined without reference to actual physical distance but merely in terms of the number of locations intervening between any two locations.

Furthermore, we can understand why Kosslyn holds that the positive answers of the 49 people in the example cited earlier form a functional picture of the cross figure in figure 3.1. Given the context provided by the questions, Kosslyn takes each token of the term “filled” to represent a cross figure part. These tokens are themselves representationally simple. Hence, the scattered entity—call it “$S$”—composed of these tokens has no representational parts that do not represent parts of the cross figure. Hence, $S$ meets condition (i). $S$ also meets both conditions (ii) and (iii) without the qualifications about point of view and appearance, assuming we agree that a sufficient number of relative surface distance relations among parts of the cross figure
are represented in S, as condition (ii) requires. Hence, S is a functional picture of the cross figure. By contrast, a description such as “the cross-shaped figure in figure 3.1” or “the figure composed of 11 darkened squares located within the central column and the third row from the top in the diagram on page 35” would not be a functional picture of the cross figure, since none of the conditions (i)-(iii) is met. Not even a list that expressed in written sentences of the form “Square (n,k) is filled” the information that is conveyed by all the positive oral responses of the people would qualify as a functional picture of the cross figure. This is because such a list does not meet condition (i): there are representationally complex parts of the list (e.g., “(3,2) is filled”) whose component representational parts (e.g., “2,” “3,” “is filled”) do not represent parts of the cross figure (but rather represent numbers and the property of being filled). Hence, although quasi-pictures are not full-fledged realistic pictures, they nonetheless represent in a different way than either sentences or descriptions. Hence, Kosslyn cannot be charged with taking a view of mental imagery that does not provide a significant alternative to the view of Pylyshyn and other descriptionalists.

Various passages in Kosslyn’s writings suggest that Kosslyn often has a more restrictive understanding of the notion of a quasi-picture than the one supplied above. In these passages, it seems clear that a quasi-picture is supposed to be employed in a picture-like representational way by the cognitive system of which it is a part. That is, not only is the representation taken to have a picture-like structure vis-à-vis the object it represents, but it is also taken to be subject to processing, within the given cognitive system, that is suitably structure-sensitive. Let me elaborate on this point.

Pictures, like maps, can be used to determine the presence or absence of a variety of different spatial relationships among parts of the items they represent, for example, whether parts A, B, and C fall on a straight line, whether they are adjacent, whether A is farther from B than from C. Quasi-pictures, on the present understanding, in virtue of being quasi-pictures, are subject to processing that is sensitive to their internal representational structure and that thereby enables the cognitive systems of which they are parts to treat them as if they were pictures with respect to such uses. On this reading of Kosslyn, we may propose the following analysis of quasi-picturing in place of the first one:

A representation R is a quasi-picture of an object O as seen from point of view V for person P or system S if, and only if, (i) the three conditions in the first definition are satisfied; (ii) there are processes within P or S that operate upon the parts of R in a way that results in their functioning with respect to the determination of a variety of spatial relationships among parts of O as they would were they parts of a real picture of O as seen from V.

This definition seems to me compatible with the general framework of Kosslyn’s position.

One further aspect of Kosslyn’s conception of the picture theory must still be introduced. Consider again a cathode ray tube screen on which a picture is displayed. The screen may be thought of as the medium in which the picture is presented. This medium is spatial, and it is made up of a large number of basic units or cells, some of which are illuminated to form a picture. Analogously, according to Kosslyn, there are various functional spatial media, each made up of a number of basic units or cells. These units or cells may be active or not. For example, in the case of the represented cross figure, the functional spatial medium is made up of the 49 responses. Those responses that are positive, that is, those that token the word “filled” in answer to a question, are the active units in the functional medium. Those responses that are silent are the inactive units. Each of the former responses, by virtue of being active, represents the presence of a filled square at a particular spatial location in figure 3.1.

We are now ready to state the basic thesis of the only picture theory of imagery that has been worked out in any detail: mental images exist in a medium that functions as a space; they are themselves functional pictures in this medium. Kosslyn hypothesizes that the imagery medium, which he calls the “visual buffer,” is shared with perception. In veridical perception, any given unit in the medium, by being active, represents the presence of a just noticeable object part at a particular spatial location within the field of view. In imagery, the same unit, by being active, represents the very same thing. Thus, imaged object parts are represented within an image as having certain viewpoint-relative locations they do not in fact occupy, namely, those locations they would have occupied in the field of view had the same object parts produced the same active units during normal vision. Kosslyn hypothesizes further that the visual buffer is roughly circular in shape. What he means by this hypothesis is not that the buffer is literally circular but rather that if all its component cells were active, the object represented would be circular (or at least would appear to be circular). Admittedly, Kosslyn is not very clear on this point or on certain other characteristics of the visual buffer (and the images formed in it). For example, he often speaks as if his
theory requires that represented relative distances actually obtain between the appropriate image parts. These ways of speaking have caused considerable confusion. But the fault lies at least partially with Kosslyn’s readers. For there is no more reason to take such talk literally than there is to take literally our everyday ascription of colors to mental images. In speaking of an image as green, say, as I noted in chapter 2, we are not asserting that it has the real color green. Rather, we are saying that it has a quality that represents that color. And what is true here for colors is true mutatis mutandis for relative distances.

Another illustration of this point is found in the application of words like “loud” or “high-pitched” to graphical representations of sounds. As Ned Block has noted, it is commonplace for people who work with oscilloscope readings to use such terms in connection with the readings themselves. In this usage it is obvious that what “loud” and “high-pitched” really mean are “represents loud” and “represents high-pitched” respectively.

Kosslyn postulates that there are three basic types of processes that operate on images in the visual buffer, namely, those that “generate,” “inspect,” and “transform” the images. The generation process acts on information stored in long-term memory about the appearances of objects and their spatial structure, and, from this, it creates an image in the buffer. We are not conscious of the information in long-term memory on which the generation process acts. Rather, what we consciously experience is the pattern of activation that results in the visual buffer. On Kosslyn’s view, the generation process itself is decomposable into further processes; but these need not concern us now. The inspection process is also really a number of different processes that examine patterns of activated cells in the buffer, thereby enabling us to recognize shapes, spatial configurations, and other characteristics of the imaged objects. For example, if I form an image of a racehorse, it is the inspection process that allows me to decide whether the tip of its tail extends below its rear knees. Similarly, if I image the Star of David by mentally superimposing two triangles, the inspection process is what enables me to recognize the hexagon in the middle. Finally, there are transformation processes. These processes “rotate,” “scale in size,” or “translate” the patterns of activated cells in the buffer. I shall have more to say about image transformations in section 3.3.

That, then, in outline is Kosslyn’s theory. The overall structure of his position may be diagrammed as shown in figure 3.2.

Before I close this section, I want to mention one alternative way in which the picture theory could be developed. This gives us a more robust version of the view that mental images are picture-like.

Consider again the retinotopic representations. One fact about these representations that is not utilized within the earlier analysis of quasi-picturing is that, in a quite literal sense, adjacent parts represent adjacent parts of the retinal image. There is, then, an orderly topographic projection of the retinal image onto the visual cortex. We know this from experiments in which a recording electrode is placed inside the cortex. Greater neural activity is picked up by the electrode when light is shined onto a particular spot on the retina. Moving the electrode a little results in the continued registration of greater activity only if light is directed onto an adjacent part of the retina.

Topographic organization of this sort is found in many brain areas. For example, in the somatosensory cortex there is an orderly representation of the surface of the human body that is structured in the same general way. Here adjacent regions of the body surface are projected onto adjacent regions of the cortex. Enhanced activity in one of the relevant cortical regions indicates that the region of body surface projected onto it is being touched. Some relatively small portions of the body (e.g., the hands and face) provide input to more neurons than do some relatively large portions (e.g., the trunk). Thus, when people are asked whether two separate points are being
touched on their faces or just one, the smallest interval at which they can feel both points is much less than the smallest interval when the points are located on the trunk. In the motor cortex, the body surface is projected in much the same way as in the somatosensory cortex, the main difference being that now enhanced activity in a cortical region represents movement in a corresponding region of the bodily surface. Since the hands and face are projected more fully than other body parts, it is not surprising that the finest movements we are capable of making involve our hands and faces.

The fact that neurons in different regions of the brain are organized into topographic representations like those described above naturally leads to the conjecture that the imagery system itself employs such representations. If this is so, then it seems to me there will be a more robust sense in which mental images are quasi-pictorial than I have so far admitted. Let me explain.

Instead of the first definition of a quasi-picture, we might now propose the following account:

A representation $R$ is a quasi-picture of an object $O$ as seen from point of view $V$, if, and only if, (i) every part of $R$ that represents anything represents a part of $O$ visible from $V$; (ii) a sufficient number of apparent adjacency relationships among parts of $O$ visible from $V$ are represented in $R$; (iii) any apparent adjacency relationship among parts of $O$ that is represented in $R$ is represented in such a manner that the parts of $R$ representing those $O$ parts are (literally) adjacent to one another.

I have ignored here the later requirement that quasi-pictures be employed in a picture-like way by the cognitive system of which they are parts solely to simplify my statement of the new proposal. Obviously, this requirement may easily be added to the three conditions formulated above.

The comments (1)–(5) made with respect to the first proposal still apply. As far as comment (6) goes, there is one change: since the above definition obviously entails that every part $R$ that represents anything is spatially within $R$ as a whole, the notion of "part" at work must now be understood spatially. There is one further comment I want to make on the new proposal. Condition (iii) is stated in such a way that it does not entail that any two adjacent $R$ parts represent apparently adjacent parts of the represented object. This is because there could be a quasi-picture (e.g., a crumpled rubber sheet on which a picture is drawn) that has some adjacent representational parts that do not represent apparently adjacent parts of the object (see figure 3.3).

Figure 3.3
(a) Crumpled sheet (side view). $A$ is adjacent to $B$. (b) Uncrumpled sheet. $A$ is not adjacent to $B$. (c) Represented face. $A'$ is not adjacent to $B'$. ($A$ represents $A'$; $B$ represents $B'$.)

It seems to me entirely reasonable to maintain that any item that is a quasi-picture in the sense just elucidated is picture-like in important ways. Furthermore, any such item will count as a quasi-picture in the first sense. The converse, however, is not true. For example, the oral representation consisting of the positive responses of the 49 people will not pass the new condition (iii), since the people can stand wherever they please. Thus, the new definition gives us a more robust concept of quasi-picturing than did the first one. As a result, the hypothesis that mental images are quasi-pictures is now bolder than before and therefore more vulnerable to empirical refutation.

3.2 The Picture Theory and the Digital Computer Model of the Mind

It is often supposed that Kosslyn's picture theory is inconsistent with the digital computer model of the mind. For example, Ned Block says the following:

If the pictorialist view is right, then the human brain deploys representations (and processes operating over them) of a sort not found in digital computers (whose representations are paradigms of descripcional representations). So digital computers would not be able to process information in the manner of humans (though of course they might nonetheless be able to simulate human information processing).
Elsewhere, Block asserts:

The relevance of the pictorial/descriptive controversy to the viability of the computer metaphor in cognitive science should be becoming visible. The computer metaphor goes naturally with descriptive representations, but it is not at all clear how it can work when the representations are nondescriptive.  

Similarly, Hubert and Stuart Dreyfus comment:

[Computers, programmed as logic machines, cannot use images or any pictur-like representations without transforming them into descriptions.]

These statements reflect a serious misunderstanding of Kosslyn’s picture theory. Block and the Dreyfus brothers assume that within digital computers there are no picture-like representations. But this is not what Kosslyn himself thinks. For example, Kosslyn makes the following statements about functional pictures:

[They] can only exist in a medium that functions as a space. . . . The space can be a physical one (such as a piece of paper or a television screen) or a functional one (such as a matrix in a computer's memory).

[There is no physical matrix—actual glass screen—inside a computer on which pictures are displayed; rather, cells in a hypothetical matrix are represented as entries in the machine’s memory. The computer identifies these elements in a way that results in their functioning as if they were arranged in a visual array.]

But how can a digital computer contain functional pictures? The thought that there is a difficulty here rests, I think, on something like the following line of reasoning: Suppose that the responses of the 49 people in the earlier example are translated into ordered combinations of numbers, for example, “n,k,1” and “n,k,0,” where the first of the three numbers indicates row, the second indicates column, and the final “1” or “0” represents whether or not the square is filled. A list of these combinations of numbers can be entered into a computer’s memory, and the information stored may be used to generate a picture on the computer’s display screen. Now this list is made up of descriptive representations. Hence, it is difficult to see how, as Kosslyn supposes, there can be a functional picture of the cross figure inside the computer that is not itself descriptive.

This line of reasoning is seductive but fallacious. Let me explain. I shall focus initially on the first definition of functional picturing. A list of coordinates stored in a file on a computer disk, a list made up of descriptive equivalents of sentences of the forms “Square (n,k) is filled” and “Square (n,k) is empty,” admittedly does not itself have members that together form a functional picture, since it is evident that condition (i) in the initial definition is not met. However, if the computer is running a program that requires it to access this file in such a way that somewhere else inside the computer, for each of the above descriptive representations of the form “Square (n,k) is filled,” a certain inner cell is actually filled (e.g., by charging electrically a certain physical region), then there will be an inner functional picture made up of these filled cells (charged regions), assuming that conditions (ii) and (iii) in the first definition are met as well as condition (i). Thus, the crucial distinction is between, on the one hand, the sentences we use to describe various filled cells or the sentences the computer uses to identify certain cells to be filled and, on the other hand, the cells so described or identified.

The above computer example is not purely hypothetical. Digital computers used for graphics contain (and manipulate) both descriptive and functional-pictorial representations, the former making up unstructured lists on files, the latter being located in what are known as “arrays.” The Appendix contains a simple program that requires setting up internal arrays for the purposes of rotating a line and displaying the rotation on a monitor screen. Thus, Kosslyn’s pictorialism (as I initially elucidated it) really poses no threat to the digital computer model of the mind. Indeed, the contrary is the case.

Is there any threat to the digital computer model, if pictorialism is elucidated in the stronger ways connected with the second and third definitions at the end of section 3.1? Again, it seems to me that there is not. As far as the second definition goes, it is unproblematic to suppose that there can be suitable structure-sensitive processing of the appropriate representational structures within digital computers. The contents of internal arrays can be scanned and rotated, for example, in the very same incremental ways that Kosslyn hypothesizes quasi-pictures generally can be scanned and rotated.

In the case of the final definition, we need only realize that the cells in an internal array that are treated by the computer via its program as adjacent could be realized physically by machine parts that are literally adjacent to one another, although, of course, typically the relevant machine parts will be physically separated. On the computational model, then, there is nothing to preclude the relevant parts from being physically adjacent: it’s just that if they are, their
being so does no direct representational work. What matters to the representation of adjacency via cells of an internal array is that the program be such that the appropriate cells are identified as if they were adjacent to one another. I conclude that the hypothesis that mental images are quasi-pictures can be accommodated within the digital computer model.

3.3 The Experimental Evidence for Kosslyn's Account

Kosslyn and his fellow workers have marshaled a very large quantity of empirical evidence in support of their position. In this section, I shall review some of this evidence. Let me begin with the claim that vision and imagery share a common fixed medium. If there really is a shared medium utilized in both seeing and imaging, then there should be interference effects between the two. This is indeed the case. For example, in one experiment subjects were shown figure 3.4 and asked to image it. They were then told to image the star moving clockwise around the letter and to use their image to decide whether each corner of the imaged letter that the star passed was attached to an upper edge. One group of subjects was told to say yes if the corner was so attached and no otherwise. For this group, then, the correct answers were no, yes, yes, no, yes, yes, no, no, no. A second group of subjects was told to give their responses by pointing at a Y or an N on a blackboard resembling figure 3.5. In this case, then, the subjects had to search visually for a response at the same time that they were inspecting their images. It was found that the

![Figure 3.4](image_url)

Figure 3.4

second task took much longer—just what one would expect if there is a common medium.

In another experiment, subjects were shown patterns of black vertical stripes against a red background and black horizontal stripes against a green background. They looked at these patterns for 10 minutes, switching back and forth between the two. They were then presented with a pattern of black vertical and horizontal stripes against a white background. The subjects reported that the vertical stripes were tinged with green and the horizontal ones were tinged with red. This effect is known as the "McCollough effect." A similar effect is obtained with imagery. In this case, subjects were shown a red patch and asked to imagine black vertical stripes on it. They were also shown a green patch and asked to imagine black horizontal stripes. They did this alternately for 10 minutes. They were then shown the same black-and-white pattern as before. The same effect resulted, although the colors were reported to be generally fainter. This strongly suggests that at least some of the same mechanisms are at play in both imagery and perception. Shared mechanisms are a central feature of Kosslyn's theory—in addition to a common medium, there are also common inspection procedures.

Here are three further experiments that support the claim of shared mechanisms. Roger Shepard showed a group of subjects a matrix and asked them to imagine a letter in it by mentally blacking in certain areas. A dot or dots were then placed in the matrix, and the subjects were asked whether the dot or dots fell on the imaged letter. The experiment was then repeated with a real letter in the matrix instead of an imaged one. It was found that in both cases the relative
response times were the same. For example, when a single dot was placed off the letter, the farther away from the letter it was, the faster the decision was reached. When more than one dot fell on the letter, again a faster response was given.

The second experiment involved stroke victims suffering from a condition known as “unilateral visual neglect.” These people have great difficulty in seeing objects on one side of their visual field. For example, if a finger is wiggled on both sides of their visual field simultaneously, they will report seeing only one of the two wiggling. They do see both finger movements, however: if only a single finger is wiggled, they will report seeing it (whichever side it is on). People with this defect duplicate it in imagery. For example, an Italian man was asked to imagine a favorite piazza and to describe the buildings in it using his image. In his description, he systematically ignored all the features of the buildings on the right side of the piazza relative to his imagined point of view.

The third experiment required subjects to briefly view a pattern (e.g., the Star of David) and then, after its removal, to judge whether some simpler subpattern had been present. The subjects responded by generating an image and inspecting it for the relevant part. It was found that certain subpatterns were discovered faster than others, namely, those that were “good” subpatterns in the Gestalt sense, just as in the perceptual case. For example, the parallelogram facing right was harder to pick out than the two main triangles in mental images of the Star of David (see figure 3.6). The main difference between the case of imaging and the case of seeing a pattern was the speed of the answers. In imagery, the answers took longer. This fact does not undermine Kosslyn’s claim that common representational procedures are at work. Rather, it suggests that factors in addition to the Gestalt laws of organization are relevant. One possibility proposed by Kosslyn himself is that sustaining an image requires effort, so that it is harder to inspect an image than a pattern on paper. This possibility fits in well with the results of other experiments that indicate that more time is required to “see” portions of more complex images. For if images begin to fade as soon as they are generated in the visual buffer, more complex images will be harder to sustain and all images must be refreshed with new parts, if they are not to disappear.

In Kosslyn’s view, then, imagery and perception share various inspection processes and the same medium. I turn next to the evidence that is supposed to support Kosslyn’s claims concerning the structure of this medium. In one experiment, subjects were told to form an image of an object in the distance and to imagine themselves walking toward it. They were then asked whether there was a point at which not all of the object could be seen. They all answered affirmatively. Kosslyn takes this result to show that the visual buffer has a limited spatial extent. What he means by this claim is really that the visual buffer has a limited number of basic representational units or parts. Initially, that is, when the object is imaged in the distance, not all of the units in the medium are active. As the object is imaged at closer range, however, more units become active, each one representing a small part of the object visible from the relevant point of view, until eventually all the units are active and the object fills the image, so to speak. From here on, imaging the object any closer requires the imager to leave out parts of the object. Thus, the object “overflows” the image. The same result occurs in perception, of course. As one walks toward an object one is seeing, the object eventually “overflows” one’s visual field. The fact that imagery is like seeing in this respect does not itself suffice to explain image “overflow.” One can still ask what it is about seeing that generates “overflow” there, to which Kosslyn’s response is, “A medium with a limited spatial extent.”

In another experiment, subjects were shown a 1-foot ruler horizontally mounted on a wall at eye level. They were then told to image the ruler as shown and to imagine walking toward it. At the point at which the ends of the imaged ruler began to “overflow” from their image, they were asked to estimate how far away from the wall they would have been, had they been viewing the ruler with their eyes and had it appeared just as in their image. The experiment was repeated with the ruler in the vertical position and then again with the ruler at 45 degrees. It was found that the distance estimates were roughly the same in all three cases. Kosslyn says that this shows
that the visual buffer is roughly circular in shape. This claim is not to be taken literally, as I noted earlier. What Kosslyn really means is that when all the units in the buffer are active, a circular object or an apparently circular object will be represented. Just how does Kosslyn reach this conclusion? He doesn’t say. Presumably the reasoning goes as follows: Assuming an imagery medium with a limited number of units, in imagining oneself walking toward the horizontal ruler, one is activating more and more units representing visible ruler parts. At the point of “overflow,” all the units available for representing horizontal object parts will be active. What the data show is that the same number of units are active at this point whether the ruler is horizontal, vertical, or at 45 degrees. It follows that if all the units are simultaneously active, an object will be represented that is the same apparent length in all three directions—that is, a circular (or apparently circular) object—assuming, of course, that similar results are found for other intermediate directions.

Kosslyn also claims that the imagery medium has a grain. Here Kosslyn is to be understood as asserting that the medium has basic representational parts that cannot represent object parts smaller than a certain size, as seen from a certain distance. This is shown, Kosslyn thinks, by experiments in which subjects take longer to see subjectively smaller parts of images. For example, when subjects imaged a rabbit next to an elephant, they took longer to see the rabbit’s whiskers clearly than when they imaged a rabbit next to a fly. In the former case, Kosslyn claims that the rabbit’s head initially appeared too small for its whiskers to be clearly represented in the subjects’ images. Therefore, the subjects employed a “zooming in” process that transformed the image part representing the rabbit’s head until it appeared large enough for the whiskers to be clearly visible.

Kosslyn maintains that the resolution in the imagery medium decreases toward the periphery. The experiment in this case required subjects to inspect visually a pair of small dots located in the center of a blank field. The dots were then removed, and the subjects imagined that they were still present. Next the subjects imagined that their focus of attention was moving away from the dots until they could no longer tell that the dots were separate. It was found that the greater the distance between the pair of dots, the farther from the center of the image field the dots could still be resolved. A parallel result was obtained in the perceptual case. On Kosslyn’s view, this demonstrates that the basic representational units in the visual buffer represent larger regions toward the periphery, so that resolution there is not as good as in the center. As Kosslyn puts it,

“In the highly resolved central regions the grain is smaller and hence resolution higher.”

Why should this be so? One explanation that seems to me rather plausible is this: Since the receptive fields on the retina become larger and correspondingly less sensitive with increasing distance from the fovea, the visual buffer needs to be most highly resolved with respect to material in the central regions of the field of view. Again there is a parallel with the retinotopic representations. Here there is a larger proportion of the cortex devoted to the projection of the foveal area of the retina than elsewhere. Why? Because there is a greater density of photoreceptors around the fovea.

I turn next to the experiments on mental image scanning. In Kosslyn’s well-known map-scanning experiment, subjects were required to study the map shown in figure 3.7. When the subjects had become familiar enough with the map to be able to draw it, they were asked to form a mental image of it and then to focus on one particular object in the image. This request was repeated for different objects. It was found that the farther away an object was from the place on the image presently being focused on, the longer it took to focus on that new object. For example, shifting attention from the “lake part” of the image to the “hut part” took longer than shifting attention from the “well part” to the “hut part.”

In another experiment performed by Ronald Finke and Steven Pinker, subjects were shown a pattern made up of dots on a screen. The pattern was removed, and the subjects were told to form an image of it just as it had been on the screen. An arrow was then flashed, which, in half the trials, pointed to a previous location of a dot. Subjects were asked whether there was an imagined dot toward which the arrow pointed. When the arrow pointed to where a real dot had been, it was found that the time taken to answer increased linearly with the distance between the tip of the arrow and the dot.

Pictorialists take these experiments to show that mental images can be scanned at fixed speeds. How exactly does this hypothesis explain the results? After all, on the pictorial view, images are not so constituted that their parts bear the same relative distance relations to one another as the object parts they represent. The answer goes as follows: Scanning across a mental image involves accessing the appropriate image parts serially (either by shifting the locus of attention across a stationary image or by translating the imaged pattern across the visual buffer so that different aspects of the pattern fall under a fixed central focus of attention). More specifically, in the map case, scanning across the image involves accessing one after another the members of a sequence of representationally simple im-
age parts, each of which represents a different, just noticeable location on the map situated on a line connecting the figures represented at the beginning and end of scanning. Thus, if the image has parts A, B, and C that represent respectively map parts X, Y, and Z, and X is nearer to Y than to Z, then scanning across the image from A to B will involve successively accessing fewer image parts than scanning from A to C. Thus, assuming a fixed scanning speed, Kosslyn’s view predicts that the time it takes to scan from A to B will be shorter than the time it takes to scan from A to C. And this is indeed the result we get.

There may seem to be a tension between the account just offered of image scanning and Kosslyn’s claim that the resolution of the visual buffer is such that its representationally simple parts represent larger material regions toward the periphery. For if the just noticeable map parts vary in size according to their position in the field of view, there will be cases where the number of image parts scanned does not increase linearly with the real distance on the map. The experiments on resolution, however, suggest that it is only rather close to the periphery that resolution diminishes significantly. Since, in the scanning experiments cited above, there is no scanning in peripheral regions, the changes in resolution in the buffer play no role. With respect to the operation of the scanning process in the above cases, Kosslyn takes the view that it consists in translating the image pattern across the buffer so that new aspects fall under a fixed central focus of attention. On this model, the buffer parts or units systematically change their activation levels during the scanning process. This is illustrated in figure 3.8. Thus, the parts of the buffer that are being

![Diagram](image.png)
attended to during scanning—namely, those that lie in the fixed region of central focus—remain the same.

Kosslyn maintains that the scanning process normally, though not always, operates as he supposes it does in the cited experiments. He notes, for example, that “it seems easy to scan around the four walls of an imaged room, never ‘bumping into an edge’.” This would not be possible, if scanning always involved moving the locus of attention across a fixed image pattern. For the pattern of activation in the buffer at any given time represents an object as seen from a given point of view, and points of view are restricted by the limited visual arc subtended by the eyes.

Why do subjects scan across their images bit by bit rather than simply letting them fade and replacing them with new ones whose parts have appropriately different positions, so to speak? One possible explanation is that moving an activation pattern already in the medium is easier. In other words, allowing an image to fade and then going back into storage to construct another appropriately different image may be more complicated (in terms of both the number and the complexity of the operations). If this is so, then, since effort in scanning increases with the extent of the transformations (and the number of iterations), there should arise a point at which the price paid to scan rather than to generate a new image is too high. It appears that there is indeed such a point.

As to why scanning is done incrementally, one hypothesis is that such a process minimizes the noise introduced into the image by the transformation operation (i.e., the number of random neural events that interfere with and hence distort the image). Another hypothesis is that in the buffer there are hardwired connections only between those units that represent, when active, neighboring locations. If this is the case, and if scanning involves transferring activation from the unit attended to at the beginning to the one attended to at the end, then scanning will have to involve iteratively transferred activations.

Another important transformation process operating on mental images is the process of rotation. The experiments that Kosslyn and others have taken to establish the existence of this process were conducted originally by Roger Shepard and Nancy Metzler. Subjects were shown 1600 pairs of block figures like those in figure 3.9 and asked whether they were congruent or not. It was found that, as the angular separation of the block figures in each pair increased, so, in linear proportion, did the length of time each subject typically needed to respond. When asked how they reached their answers, subjects reported imagining one figure rotated so as to superimpose on the other. Conclusion: people can rotate mental images and at fixed speeds.

In a later experiment, Metzler took a group of the original subjects and presented them with a single figure. She then asked them to imagine the figure (as seen) and to rotate the image in a clockwise direction. Based on calculations of the subjects' rotation speeds from the earlier experiment, she next presented rotated versions of the figure, the orientations of which should have matched that of the image. So, for subjects who rotated at 40 degrees per second, she "flashed" before them an 80-degree rotated figure after 2 seconds or a 160-degree rotated figure after 4 seconds, for example. Subjects were asked whether the imaged figure and the "flashed" one were congruent or not. The response times did not vary with the degree of rotation of the "flashed" figure, and they were uniformly short.
and positive. Metzler took this to show that she had matched the images at their intermediate orientations with the rotated figure.

The findings of Shepard and Metzler have been replicated in a number of other experiments. Their claim that mental images can be rotated is not to be taken entirely literally, of course. On their view, image rotation is a process that changes images in the same way percepts are changed during the perception of a rotating object. Thus, image rotation transforms images bit by bit so that they represent objects at gradually increasing orientations. This conception of image rotation is one that Kosslyn endorses, and it provides a straightforward explanation of Shepard and Metzler’s experiments: Time increases linearly with increasing angular separation of the block figures because, with greater angular separations, more incremental transformations are needed in order to arrive at images that represent superimposed figures.

On the above view, there is a sense in which image rotation is an analogue process: it changes images in a way that is analogous to the way that percepts change during the perception of a rotating object. In a corresponding sense, image scanning is also an analogue process. It is sometimes said that image rotation is an analogue process in a stronger sense, namely, an analogue of physical rotation. If this means that image rotation is a process that makes images go through a series of ordered states that correspond one to one without exception with the states an external object would go through were it rotated, then image rotation must be continuous rather than incremental. This is not how Shepard and Metzler themselves think of image rotation (some of Shepard’s own statements notwithstanding). Nor does it fit Kosslyn’s finding that the medium of imagery and perception has a grain. Nor finally is it supported over the incremental hypothesis by the results of the rotation experiments.

So far in this summary of the experimental data, I have said very little about the neuropsychological evidence. There is considerable neurological literature, however, concerning the loss of imagery following brain damage of one sort or another. Some of this literature suggests that the imagery system utilizes not only visual representations about the literal appearance of objects but also spatial representations about the layout of objects in space. This presents no real difficulty for Kosslyn’s theory, however, since the representations in long-term memory from which quasi-pictures are generated are taken to be both visual and spatial. In chapter 8, I shall address some significant neuropsychological data on image generation—data that are easily accommodated by Kosslyn’s theory. In general, it appears that the patterns of deficits and continuing abilities that are found in patients with brain damage can be explained on the hypothesis that imagery is a system, the components of which are structures and processes conforming to Kosslyn’s model.

That completes my summary of the experimental data and its interpretation. I shall have more to say about both topics in chapters 4 and 5.

3.4 The Role of Quasi-Pictures in Cognitive Tasks

Why do we have mental images, conceived of as quasi-pictures, at all? What role do representations in this special format play? Kosslyn’s answer is that quasi-pictures are useful for a number of different cognitive tasks.

Consider the following questions: Which is larger, a mouse or a hamster? Does a bee have a dark head? Do frogs have lips or stubby tails? What shape are an elephant’s ears? How many windows are there on the front of your house? Many people report using images to answer these questions. This alone proves nothing, of course—perhaps such reports are mistaken. But Kosslyn has conducted an extensive series of experiments showing that people indeed use images when they are required to respond to questions about parts or properties of objects that are, in Kosslyn’s words, “poorly associated with the objects”—that is, parts or properties that people usually have not thought about in connection with the objects before, provided that such parts or properties are also not deducible from properties of the superordinate classes to which the objects belong (as is the case with the question, Does a bee run on gasoline?).

The fact that imagery is used in the above way can be explained given the following hypotheses: When we see a new object, we typically record certain facts about its structure by storing in memory a linguistic description of the object. But there are many facts we do not typically record in this manner, such as the shape of an elephant’s ears. For facts pertaining to the object’s appearance, we often store information in structures that are not lists of propositions or descriptions, information that we did not foresee needing to know when we initially saw the object. By generating a quasi-picture from such information and applying the appropriate inspection routines, we can easily answer questions about poorly associated properties or parts. Thus, just as it is much easier to see whether three cities lie on a straight line by looking at a map than by performing calculations on a list of descriptions of their longitudes and latitudes, so too it is often much easier to construct and examine a mental map or quasi-picture than it is to proceed in any other way (and often, of course,
on Kosslyn’s view, there will be no other way in which we could proceed, given the nonpropositional format of much of the information we have stored in long-term memory about the appearances of objects.

Another task for which imagery is useful is determining spatial relations among nonadjacent parts of objects. Suppose that I am asked whether the tips of a standing elephant’s tusks are higher or lower than the top of its legs. This question is not difficult to answer if I am able to construct an internal representation of an elephant from which I can read off the positions of its various parts within a single viewer-centered reference frame, as I can, for example, by comparing the addresses of the appropriate activated cells making up a quasi-picture. But it is much more difficult, if the sole elephant representations I have available are ones that utilize “distributed” coordinate systems, that is, coordinate systems that only specify the positions, angles, and sizes of object parts relative to other parts of which they are immediate parts (e.g., the tusks relative to the face, the face relative to the head, the legs relative to the torso). In these circumstances, I cannot simply compare the coordinates of the tips of the tusks to those of the top of the legs. I might add that a number of cognitive scientists believe that inner representations with distributed coordinate systems play an important role in shape recognition in visual perception. I shall have much more to say on these representations in chapter 4.

Images are also useful for solving certain abstract problems (e.g., Tom is wiser than Paul, James is less wise than Paul, who is wisest?). Solutions are achieved by translating the entities of the problems into imagined objects, applying the appropriate image transformations if any are needed (e.g., rotation), detecting the resulting spatial relations and properties, and translating back to the problem entities. So, in the case of Tom, Paul, and James, one can solve the problem very easily by imaging a dot for each person, and by placing the dots to the left or right of one another in an order corresponding to the men’s relative wisdom. It is not surprising that imagery is useful here if images are quasi-pictures. Since a quasi-picture represents its objects as seen from a single point of view, it cannot help but depict their left/right relationships relative to that point of view.

In this chapter, I have tried to clarify the basic features of the picture theory of mental images within contemporary psychology and to summarize the experimental data that Kosslyn and others take to ground the view. In chapter 4, I turn to an alternative conception of imagery that also enjoys significant support among cognitive psychologists.

Chapter 4

Mental Images as Structural Descriptions

The view that mental images are quasi-pictorial representations has been hotly contested by some influential cognitive scientists. In this chapter, we shall examine the most widely accepted alternative account: that images are structural descriptions.

The composition of the chapter is as follows: In section 4.1, I explain what a structural description is and I discuss the charge that the descriptive view of images makes them epiphenomenal. In section 4.2, I explain how Zenon Pylyshyn, one notable descriptionist, tries to account for the results of Kosslyn’s experiments on imagery by means of the doctrine of task demands and tacit knowledge; I also summarize the experimental evidence that Pylyshyn takes to favor his approach. In section 4.3, I turn to the descriptional view elaborated by Geoffrey Hinton. This view, unlike Pylyshyn’s, grants that there are special processes operating on mental images and a special format for imagistic representation. Finally, in section 4.4, I show how Hinton’s approach arguably has no need of the doctrine of tacit knowledge, and I explain why Hinton believes that there is experimental data that strongly support his position.

4.1 Structural Descriptions and Epiphenomenalism

A structural description of an object is simply a complex linguistic representation whose basic nonlogical semantic parts represent object parts, properties, and spatial relationships. The explicit representation of properties and spatial relations is one key difference between structural descriptions and quasi-pictures. Consider, for example, the representation of relative distance relations in quasi-pictures. We saw earlier that this is achieved indirectly via the number of image parts: one part more distance. No explicit representation is possible here, since every part of a quasi-picture that represents anything represents an object part. In a structural description this is not the case, however. The fact that A is farther from B than from C can be