The picture, particularly one printed on paper," according to Biesheuvel (1949), "is a highly conventional symbol, which the child reared in Western cultures has learned to interpret" (p. 98), and the orthodoxy still holds that unsophisticated subjects are puzzled by even clear photographs. "A Bush Negro woman," Herskovits wrote (1948), "turned a photograph this way and that, in attempting to make sense out of the shadings of grey on the piece of paper she held" (p. 381). Some observers say that nonpictorial peoples find pictures mere daubs. "The natives are frequently quite incapable of seeing pictures at first, and
wonder what the smudge is here for" (Kidd, 1904, p. 87). The conclusion is "one can regard the photograph as we use it as an arbitrary linguistic convention not shared by all peoples" (Segall, Campbell, and Herskovits, 1966, p. 33).

Cross-Cultural Research on Pictures

Over the last ten years, the informal observations of anthropologists and essayists have been supplemented by powerful research studies, some of which support the view that untrained subjects are puzzled by "our sophisticated pictures," but other research has begun to challenge this orthodoxy. These arguments and counterarguments have to be examined closely if the consistent threads are to be seen.

Pitfalls in Cross-Cultural Research

Let us begin with some cautionary comments. In many cases, researchers have begun with faulty preconceptions, likely to hinder their considering possible explanations for their findings and likely to prevent their exhaustively checking the intent behind a subject's comments. For example, Segall, Campbell, and Herskovits propose that the "small size" of objects in a sketch or photograph shows that pictures (including photographs) are conventional in nature. (In Goodman's ready phrase, there's nothing like a photograph for turning a mountain into a molehill.) The reasoning is faulty here.

There is no "small object" in a photograph, merely a particular arrangement of pigment. Rather, there is information in the optic array for an object, and information for the size of the object, relative to its surroundings, is also in the optic array, not on the surface of the photograph. Does the phrase "small size" refer to the small angle subtended by the depicted object? If so, the debate is sheer nonsense, for the subtended angle of the real object can be varied just as much as the angle subtended by the represented object. In sum, Photographs do not contain small objects.

Hudson (1967) asked some Africans to draw an object-just one objection a sheet of paper. There were enormous variations in, the size of the drawing on the sheet. He concludes that the sizes were unimportant to the artists, which seems reasonable. But then he describes the Africans as not playing by our rules, for "in Western pictures we use size as a means for indicating distance" (p. 97). The thing is, we actually use relative size, not absolute size. Only when we compare the depicted object with other objects in the same scene can we know its size. Hudson’s conclusion could only have been drawn had he asked the Africans to draw a scene with many objects. The notion of size seems to confuse experimenters about as much as any conceivable subject.

Mundy-Castle (1966) reasoned that drawings incorporating perspective would be difficult for Ghanaian children to recognize, for perspective "is a highly abstract concept" (p. 122). But "being human" is similarly highly abstract, and the children easily recognized men in the drawings. The abstractness of a concept bears almost no relation to its use by children. "Toy" is abstract, yet it is one of the first words spoken. The same goes for words like "something" and "nothing" and "all gone." Also drawings using perspective conform to the laws of light, and so should be easier to recognize than drawings violating the laws. Finally, subjects were asked to recognize objects and their arrangement, not describe the laws of light or perspective. Simple recognition does not depend on "abstract understanding," any more than seeing a stone falling depends on understanding the laws of gravity. Mundy-Castle's reasoning seems confused.

The fact remains that anthropologists have noticed many people being puzzled by photographs. Perhaps the reason is simpler than anthropologists think. Photographs are clearly special objects. Would not anyone meeting a photograph for the first time be puzzled, not know quite what to say, but certainly deny that it was, physically, the represented object? How easy it would be for an experimenter, especially if his knowledge of the native language was less than perfect, to interpret inquisitive puzzlement as an inability to take information from pictures. It is very sure that "primitive" peoples show great curiosity over artifacts of our society--just as we show curiosity over their artifacts! Our pictures, print, jewelry, even our illusions fascinate other cultures--not because the subjects find them totally incomprehensible, but because they have a pointed,
well-controlled, systematic curiosity. Consider River's (1904) description of the interests the Todas, of the Indian subcontinent, showed in his tricks, notably his illusions:

"Two curved pieces of cardboard of the same size look very different when placed side by side. Many men came to me especially to see this illusion, and they experimented with the pieces of cardboard as intelligently as any European could have done. They tried the effect of placing the cards suddenly and gradually; they tried placing them with their shorter sides in opposition and noted that the cards then appeared of the same size and similarly they placed the cards in every variety of position relative to one another, noting when the illusion was and was not present. ...Two old men ...after much experimenting and deliberation...gave me the correct explanation, viz., that the short side of one appears shorter than it really is because it is next to the longer side of the other."

Puzzlement and experimenting need not indicate complete lack of understanding. The Todas knew a "trick" when they saw one. It is even possible to make observers who are quite adept with pictures show curiosity and to explore them, to "wonder" as Kidd put it, about photographs. To illustrate this point, let me describe a minor demonstration. I had an unusual photograph taken—the back of someone's head—and placed in an unusual place, the glass part of a partition of a room. The partitions made small cubicles, in which teachers kept office hours. The photograph was visible through the glass wall, and as students approached the cubicle, often their attention was caught by the photograph. Time and again students would first look at the photograph through the glass wall and then crane around the wall to look at the other side of the photograph. They would explain sheepishly that they wanted to see if there was a face on the other side of the photograph! The students were by no means from some isolated Patagonian tribe they were from New York.

To be puzzled by a picture is not to think that the picture is merely daubs on a surface. Indeed, mere daubs on a surface would hardly puzzle anyone. Daubs hardly invite the viewer to experiment, turning the picture this way and that. The whole game is given way, not in the anthropologists' interpretation of curiosity, but in their footnotes and asides. (There is nothing like a forgotten footnote to discomfit a major conclusion.). Kidd reports...
When a complete depiction of the whole object is shown, or when the object is of a familiar species, or when it is a familiar general type, untrained subjects usually make accurate identifications. Deregowski (1968a), in remote rural Zambia among people with little graphic art, had adult and child (twelve years old) subjects match photographs of toy animals with an array of solid toy animals. Adults showed some difficulty with unfamiliar animals, but this was the only combination of subjects and materials that proved troublesome. Children never had any difficulty, and all groups identified photographs of familiar animals.

Even if photographs were foolproof as representations, effective even for the most unschooled, one might still wonder if line drawings raise special difficulty. Outline depiction leaves out so much and asks us to accept a thin strip of black ink as a comer of, say, a room. Surely we have to be taught about outline drawing.

Hudson (1960) used line drawings like those in Fig. 11 to test many different groups of subjects in South Africa. Some of his subjects were white, some were black, some were illiterate, some educated or attending school. He found that the animals and humans in the pictures were all fairly consistently identified by all subjects, in all of his various groups. No subject ever called the outlined man an elephant, and no subject ever called the outlined elephant a man.

Mundy-Castle (1966) repeated Hudson's study with Ghanaians five to ten years old. Like Hudson he did not find any misidentifications of the man. Occasionally a tree was misidentified as flowers, a hand, or a plantain, none of which seem very far from the mark. An elephant was occasionally called a pig or a goat or some other animal, but never a man. A deer was often called a goat or a cow or a horse, which Mundy-Castle thinks is reasonable, for the deer resembles Ghanaian goats and sheep, and deer are rare in Ghana.

Beside the animal and human objects, there were in some drawings occasional sketchy lines, to depict a hill, if curved, or the horizon, if flat, and a pair of converging lines were sometimes present to represent a road. Hudson (1960) wanted to know whether perspective cues, like the convergence of the lines intended as the edges of a road, would be meaningful to his subjects. Many of his white subjects took the lines to be a road, many of his black subjects...
Hudson also tried to discover whether "overlap" or "familiar size" cues aided some groups but not others in pictorial perception. Both overlap and familiar size cues are often only weak influences on adult perceivers in Western culture (Hochberg, 1964; Kennedy and Brust, 1972). It is not surprising that many of Hudson's subjects seemed to base their replies to his question on logical argument, avoiding relying on weak perceptual cues. For example, some subjects argued that a man would not attack an elephant with a spear, so if the man in a picture was throwing a spear, it must be at the antelope, not the elephant in the picture. Some subjects told Hudson, flatly, that the pictures were ambiguous. If he wanted to question them about the pictures, the subjects said, he should tell them which view they should take.

I tested Hudson's drawings, informally, on students in my classes at Harvard. Like Hudson's African informants, my students said the drawings were ambiguous. Thus, the drawings are bait for cultural diversity and deliberate interpretation rather than spontaneous pictorial perception. Factors like one's belief about hunters and animals enter into replies to Hudson's questions. Presumably, too, such factors as general familiarity with testing procedures would be important. Some subjects know what to do about beliefs ancillary to the pictures, others do not.

Hudson did not discuss the sophistication of his subjects with tests. He did not say whether his subjects were all equally at ease. But surely when a white man pulls a black laborer away from his daily work and sits down in an office with the laborer, and begins to show the laborer little pictures, the laborer begins to feel a little anxious. Especially when the setting is South Africa, the laborer must be uncomfortable. To make matters worse, the white man waits unhelpfully through long periods without deigning to assist the laborer in answering the odd questions the white man is asking. Hudson reports that at times the response was given by the subject after a lag of one hour! What fears were in the laborers' minds we can only guess at. Any skills the laborers displayed, under this kind of treatment, can only be taken to the lowest estimates of their abilities. There is no responsible way in which the probably fearful black laborers' performance can be compared with the perfo-
performance of white children tested in the familiar, comfortable atmosphere of their own schools.

Deregowski reported that some of his subjects expected job opportunities to hinge on the result of his little tests. How can one expect subjects to behave calmly, at their best, when they are apprehensive (and possibly incredulous) at the kinds of questions being asked?

An intelligent tack was taken by Dennis, who had his tests given by a student who came from the people being tested. In Dennis's study the subjects were asked to make line drawings. The art of the region was decorative rather than depictive. The people were Bedouin tribesmen, nomads to whom any form of graphic activity is alien. The forms of local art were typically simple and rare. Occasional contact with foreigners could provide some exposure to representations, Dennis notes, on coins, bills, and can labels, for example. But exposure to pictures was not an everyday, continual process, and recognition of pictures was not necessary for the normal business of the day.

Dennis asked the subjects to make drawings, which is somewhat unfortunate. Even the worst artist may still be able to identify a picture. But at least the test is conservative, for whatever ability is shown we know is the least the people can do. The tribesmen made their drawings with pencil on paper. They drew human figures, on request, without demur or difficulty, for the most part. They did not seem to think the whole idea was meaningless. Some of the drawings were first made in outline, and then filled in by the subjects. Some subjects left the outlines and did not fill in the inside space. Some subjects would end up with a thick line for a leg, and others would have two thin lines, one for each side of the leg. Some of the tribesmen accepted single lines as depictions of cylindrical objects and others used two parallel lines to depict the boundaries of cylindrical objects. In short, the Bedouins used outlines just as we would.

Even in Western communities there are people with widely different backgrounds and experience, and cross-cultural research can be attempted close to home. Elkind (1970) studied the abilities of preschool and school-starting children from economically poor homes in the United States to see if the rarity of pictures in the homes adversely affected the children's abilities. With poor rural

Sioux children Elkind found an initial unwillingness to cooperate with the experimenter—which an insensitive experimenter could easily have recorded as a "lack of pictorial skills." When Elkind pushed and chided the children a little, they performed as well as children from homes rich in pictures. The same held true for American black children from poor urban homes.

**Styles of Representation**

One important study compared drawings based on naturalistic optics and its perspective with drawings using a convention common in the art of the region. It is reasonable to suppose that subjects would be best able to get information from a picture that uses familiar conventions. But the facts are otherwise. Deregowski (1970) asked some subjects from a Zambian culture which drawings they preferred as depictions of a set of models. Other subjects from the same culture were asked to pick out the models depicted in various drawings. Some of the drawings were "in perspective," following the canons of geometric optics. Other drawings (Fig. 12, for example), followed the style of the region, where both side views and front views would be included, Picasso-like, in one drawing; Deregowski calls this style "split representation."

![FIGURE 12. A drawing of an elephant in split-representation style.](image)

The subjects preferred drawings in the familiar style overwhelmingly (which suggests they were not overawed by the tester, for they might have chosen the "foreign" style to appease the foreigner). But the perspective drawings were more effective in helping
the subjects pick out the model that was depicted. In Deregowski's words: "The preferred drawings are in fact worse than [perspective] drawings in conveying to the subjects what the depicted object actually looks like" (p. 24:).

Deregowski's study stands alone: It isolates the efficiency of one mode of drawing from preference shown for various modes of depiction. More studies are needed to bolster Deregowski's findings. It would be surprising to find that most nonperspective styles are decorative rather than communicative, but that is the implication of Deregowski's results.

Deregowski's study also warns us against facile interpretations of drawing practices. Hudson, for example, proposed that the "unacculturated black man" who draws both side and front views in one drawing is drawing something phylogenetically and onto genetically primitive. Side and front views typify cave art, children's art, and African art. Hudson does not directly say the African is at a childish, primitive Stage of development, but the implication is there in the loaded term "unacculturated." Hudson says the unacculturated man draws what he knows and not what he sees. Would Hudson argue that one Bedouin thinks of a leg as a black patch of graphite, whereas another Bedouin thinks of it as two lines? Or would he argue that Picasso is unacculturated because he favors the split-representation style? Interpretations of drawings are touchy propositions, not to be accepted unguardedly. Deregowski helps us clarify the possibility that many practices are preferences unrelated to efficient depiction, and what one "knows" rather than what one "sees."

In another study, Deregowski (1968b) found that many Zambian subjects who misperceived by Hudson's criteria on Hudson's tests perceived more accurately on other tests. By Hudson's criteria, some subjects were failing to attend to depth cues such as perspective overlap and familiar-size cues in Hudson's drawings. But when given other sketches, brief ones of merely a few lines, the subjects would build three-dimensional objects if asked to construct the depicted objects. Cues for depth seem to be meaningful to subjects, even if this ability was not shown on Hudson's test. Page (1970) confirms Deregowski's results. If these drawings used by Hudson are indeed ambiguous, and subjects can use the cues in other situations, then problems with preference dog any attempt by Hudson to interpret his results.

Most studies using outline drawings require subjects to match lines with wires or cylinders or edges of objects. In a provocative break with tradition, Shapiro (1960) asked illiterate Rhodesian Africans to copy colored designs, using only pencil and paper. The subjects were confronted by a design on a flat surface, with areas distinguished only by color. The subjects had difficulty at times reproducing the structured designs Shapiro had concocted, which need not surprise us since the subjects were unfamiliar with tests of this kind. The intriguing result was that the subjects often attempted to depict the designs rather than to reproduce them. Instead of producing a checkerboard of areas of solid, filled-in pigment, the subjects often preferred to use a quick, efficient way of representing the test pattern, by depicting boundaries with lines. The designs were depicted in the sense that contours between areas of pigment were portrayed in outline, without trying to use the pencil like a brush, filling in the areas demarcated by outlines (Fig. 13). The results suggest that boundaries between areas of color can be depicted by line, just as edges of objects can be depicted by line, without need of training in a convention.

To close this review, it is worth noticing, in passing, that...
Dawson (1967), as part of an enormous research effort in West Africa, tried to teach subjects who misperceived Hudson's drawings (by Hudson's criteria) to improve their scores on Hudson's test. Dawson did everything one could possibly ask for in an elementary course in practical drawing. He explained about depth cues. He had subjects draw on a window lines to depict the scenery visible through the window. He had the subjects interpret their drawings. He had them transfer their drawings to paper and make fresh drawings without first drawing on the window. He familiarized them with elaborate spatial forms and a textbook on perspective, using illustrations of the forms. Almost no one in technological societies receives such thoughtful instructions! Not surprisingly, subjects' scores on Hudson's tests improved dramatically.

Unfortunately, one cannot tell why the scores improved. Did the subjects become more at ease with Dawson? Did they discover the rules of the game called "testing subjects"? Was the improvement due to one part of the training program, or was all of it necessary? That Dawson did not answer these questions is no fault of his--they were not his concern--but it will require a great deal more work to find the answers. For our purposes here, Dawson's main contribution was in demonstrating the dramatic change produced by a short training course. What the change is, Dawson can leave for others to determine.

Summary. Let me try to summarize the cross-cultural research on pictures. There is no clear consensus among psychologists about the results of cross-cultural research in picture perception. Some go so far as to call their subjects unacculturated, and they stigmatize the level of perceptual skill shown as phylogenetically primitive. Others point out that some picture-making practices are a result of a pleasure and preference; they suggest that aesthetics is as valid as communication efficiency in picture making. Some treat puzzled looks as evidence of ignorance. Some work hard to find out what lies behind disinterest in being tested by alien experimenters. Over the research there still, today, hangs a pall of confused ideas about the very devices that are being investigated. And a thoughtful reader must be disturbed by the lack of concern over the attitude the subjects may have to being tested. Anyone who hears that Hochberg's two-year-old child named drawn and photographed objects, without trouble or training, must be suspicious of claims that "primitives" see pictures as meaningless daubs. The fact is that in all the studies most subjects identified most of the depicted objects. What the depicted animals and men seem to be doing is another Story; when subjects have to say where the objects are in relation to one another, and what the objects are doing to one another, cultural differences boil up. Wild stories and rationalizations are spun when subjects are asked to do more than identify the objects in pictures. The common core to picture perception--across poor Americans, nomadic Bedouins, South African laborers, and well-schooled children--seems to be recognition of objects. People seem to recognize objects in colored or black and white photographs and in line drawings without trouble. For efficiency, one study suggests, the drawings should be in conformity to geometric laws of light.

As a supportive coda, a study on trained draftsmen in Western technological culture deserves mention. Deregowski (1970, p. 24) quotes a study by Spencer as follows: "Significantly longer time is taken in performing an assembly in accordance with instructions provided by a third-angle projection drawing [the split representation style] than when the instructions are provided by representational [perspective] drawings, in spite of the fact that the former constitutes the standard way of communication which the draftsmen are specifically taught." Spencer also found the draftsmen recognized perspective drawings faster. This study turns the cross-cultural literature on its head. If Spencer is correct, advanced technological conventions are less well understood by their users than are standard drawings based on everyday optics.

Cross-Species Research on Pictures

Hochberg and Brooks (1962) showed that an untutored child can identify pictures at the age of two years. An enterprising follow-up study showed that monkeys are as sensitive to some aspects of pictures as humans. Zimmerman and Hochberg (1963) trained a monkey to respond in one way to two triangles and to respond in a different way to a truncated solid pyramid. Then the monkeys were confronted with line drawings (see Fig. 14). The lines in different
drawings correspond to the edges of the different forms on which the monkeys had been trained. The monkeys performed as humans might, transferring their responses to the appropriate representations. Evidently it is not necessary to train monkeys in a convention for them to pick up information from line drawings.

Monkeys have been known to put their heads close to pages on which watches were drawn, as though listening for ticking, and have been observed trying to pick up drawn objects. In one important case, a chimpanzee showed these responses without any training (Hayes and Hayes, 1953). And the chimp, named Viki, readily learned to imitate actions illustrated in pictures. The chimp was initially trained and tested on black and white motion pictures, then projected stills, then photographic prints, and finally simple line drawings. "She performed fairly well from the first session on, and transferred readily through the various stages from movies to line drawings...she occasionally 'ran herself on the experiment' by plugging in the movie projector, or by getting pictures and spreading them out on the floor" (p. 471).

When tested further, Viki showed that she could accurately pick out pictures showing the same type of object as one held out by the experimenter, without the picture being an exact photograph or drawing of the experimenter's object. For example, the experimenter would hold out a toy car; then Viki would be asked to choose between a picture of another toy car or a picture of a flower. Viki would accurately pick out the picture of the car. Viki was not learning a limited set of symbols for a limited set of objects, for every test involved a new object and a new pair of pictures. On color pictures, negatives of pictures, and line drawings, Viki performed well, always with over 80 percent accuracy.

Even the lowly pigeon may have accurate picture perception. Herrnstein and Loveland (1964) trained pigeons to peck when they saw a photograph containing human beings and to refrain from pecking when confronted with a photograph not containing human beings. Each day of training, the slides were changed, or if some slides were being shown for a second time, the order was changed. "Many slides [even] contained human beings partly obscured by intervening objects-trees, automobiles, window frames, and so on. The people were distributed throughout the pictures-in the center, or to one side or the other, near the top or to the bottom, close up or distant. Some slides contained a single person, others contained groups of various sizes. The people themselves varied in appearance-they were clothed, seminude, or nude; adults or children; sitting, standing or lying; black, white, or yellow" (p. 550). Within ten training sessions the pigeons had begun to distinguish the two kinds of slides, and performance improved steadily and remained accurate when all the slides were made black and white as a test.

Some studies have used pictorial techniques in the investiga-
tion of problems not directly relevant to pictures. For example, Miller, Caul, and Mirsky (1967) and Miller (1967) allowed Rhesus monkeys to observe each other by television pictures. It was found that, without training, monkeys could react appropriately to facial expressions of monkeys depicted on television monitors. (In this case, the pictures were moving, of course, which may be a big help.)

Davenport and Rogers (1971) trained two chimpanzees and an orangutan to match a visible object with an object available only to touch. Then the primates were required to match a photograph with an object available only to touch. The primates had no experience with photographs prior to the study. Yet correct choices ranged from 80 to 100 percent across forty different pictures, in various combinations and in different testing sessions. In various sessions with black and white photographs, the primates choices were 60-100 percent correct. Davenport and Rogers conclude emphatically that apes can take information from a photograph at first sight.

Drees reportedly did a study (Hess, 1970, p. 10) possibly demonstrating picture perception in an insect. Drees presented jumping spiders (Salticidae family) with a life-sized picture of their normal prey. The spiders jumped thirty to forty successive times at the picture, and when shown the picture later would jump again at the screen. The Drees study is mostly useful for raising doubts about interpreting research with animals. Picture perception would indeed cause the jumping spider to respond. But perhaps the cue for a jumping response is a mere snatch of color or a few spindly, leglike marks. If so, the jumping response does not require picture perception; it merely requires noticing an instance, not a representation, of the cue that releases jumping. When a student sees a line drawing of a circle, he sees an instance of a circle. When he sees a line drawing of a cube, he sees a cube depicted—a picture of the cube. Thus, we have to be careful to distinguish "instances" from pictures.

The Drees Study usefully shows that it is necessary to be cautious before we interpret studies of picture perception with animals. The subjects may be responding to small parts of the picture and genuine instances of things, not to the whole picture or an object that is depicted. This caution must be applied most stringently when reflexive or instinctual behaviors are considered, for such behaviors are often tied to quite minor features of objects. European robins will attack any small red fluffy object. Stickleback fish will threaten almost any red object when a mating mood is on them. It is not necessary to suppose the robins and sticklebacks genuinely perceive a whole complete member of their species, even though they attack the red objects. To give an analogy, it is more likely they are upset by red things in the automatic way that the screech of chalk on a blackboard can send shivers along one's spine.

When a chimp puts his ear down to a picture of a watch, with its circular form and numbers, but not to a picture of a ball or to a set of numbers alone, we are on reasonable ground attributing this to picture perception. When he identifies members of the class exemplified in a picture, this is better evidence. When his identification is made tactually, though the picture was available to sight, the argument is stronger. When pigeons behave differently to almost any slide containing humans than to a slide not containing humans, and the set of slides contains hundreds of instances, with humans often only partly visible, the argument is stronger yet. I think we may say that there is sound evidence showing picture perception exists in animals without training in conventions being necessary.

**Summary**

This attack on the theory that pictures are conventions has spanned two chapters, and a summary is in order.

It seems that pictures can provide accurate information, to the point of deception, which suggests some pictures are not based on arbitrary conventions. It seems, too, that children can identify some pictures without training in a convention, though it may be some months or years before pictorial skills develop spontaneously. On the basis of the evidence on trompe l’oeil, on the accuracy of pictorial judgments, and on spontaneous recognition in children, we may be suspicious of the popular view that nonpictorial people are baffled by photographs and other pictures. Both anecdote and systematic investigations show that people from a wide variety of cultures identify line drawings and photographs of objects similarly.
and even see comparable ambiguities in pictures. Different cultures favor different interpretations of ambiguous drawings or comment in different ways on the significance of frozen postures.

The hypothesis that pictures require training in a convention seems even less likely when it becomes evident that lowly pigeons and monkeys, both, seem capable of picture perception, with no training, or the minimum of training that may be required to acquaint them with the testing procedure.