14 COGNITION IN CROSS-CULTURAL PERSPECTIVE

CHAPTER OUTLINE

Much of the literature covered so far has described the cognitive capacities and processes of people (usually adults, but in some cases children) in the United States or Europe. The implicit assumption has been that the models and theories of cognition developed from such samples are universal—that they apply to and can describe the performance and behavior of people throughout the world. However, research conducted with people from other cultures has often shown this assumption to be problematic, if not in error. In this chapter, we will examine some of this research and consider its implications for the study of cognition.

A number of issues must be discussed in order to consider cross-cultural research. First and foremost, we must come to terms with what makes a **culture**. Certainly, most would agree that people in rural India live in a different culture than people in downtown Baltimore. However, do people in rural New Hampshire experience a different culture than people living in Los Angeles?

Triandis (1996) makes a forceful argument that psychologists ignore culture at their intellectual peril:

> Almost all the theories and data of contemporary psychology come from Western populations (e.g., Europeans, North Americans, Australians, etc.). Yet about 70% of humans live in non-Western cultures. . . . If psychology is to become a universal discipline it will need both theories and data from the majority of humans. . . . Contemporary psychology is best conceived as a Western indigenous psychology that is a special case of the universal psychology we as contemporary psychologists would like to develop. When the indigenous psychologies are incorporated into a universal framework, we will have a universal psychology. (p. 407)

Psychologists, anthropologists, sociologists, and others have debated the issue of what defines a culture and have come to no widespread and clear-cut resolution to date. Cole and Scribner (1974) noted some of the ingredients of a culture: a distinct language; distinct customs, habits, and modes of dress; and distinct beliefs and philosophies. Other psychologists performing cross-cultural research have also examined factors such as ethnicity and social class in relation to performance on different types of tasks or to attitudes and beliefs (L. G. Conway, Schaller, Tweed, & Hallett, 2001; Kagitçibasi & Berry, 1989; Segall, 1986). In fact, Segall (1984) has made the argument that the concept of culture is nothing more than a collection of independent variables such as language, customs, and so on, although others (such as Rohner, 1984) disagree.

Triandis (1996) asserts that dimensions of cultural variation, which he calls cultural syndromes, can be used in the construction of psychological theories. A cultural syndrome is a "pattern of shared attitudes, beliefs, categorizations, self-definitions, norms, role definitions, and values that is organized around a theme that can be identified among those who speak a particular language, during a specific historical period, and in a definable geographic region" (p. 408). **Table 14.1** gives examples of some cultural syndromes Triandis has identified.

Table 14.1: Examples of Cultural Syndromes

Tightness	In some cultures, there are very many norms that apply across many situations. Minor deviations from the norms are criticized and punished; in other cultures, there are few norms, and only major deviations from norms are criticized.
Cultural Complexity	The number of different cultural elements, such as role definitions, can be large or small (e.g., about 20 jobs among hunters and gatherers versus 250,000 types of jobs in information societies).
Active-Passive	This syndrome . . . includes a number of active (e.g., competition, action, and self-fulfillment) and passive (e.g., reflective thought, leave the initiative to others, and cooperation) elements.
Honor	This pattern is a rather narrow syndrome, focused on the concept of honor. It emerges in environments in which property is mobile and to protect it individuals have to appear fierce so that outsiders will not dare to try to take it from them. It includes beliefs, attitudes, norms, values, and behaviors (e.g., hypersensitivity to affronts) that favor the use of aggression for self-protection, to defend one's honor, and to socialize children so that they will react when challenged.
Collectivism	In some cultures the self is defined as an aspect of a collective (e.g., family or tribe); personal goals are subordinated to the goals of this collective; norms, duties, and obligations regulate most social behavior; taking into account the needs of others in the regulation of social behavior is widely practiced.
Individualism	The self is defined as independent and autonomous from collectives. Personal goals are given priority over the goals of collectives. Social behavior is shaped by attitudes and perceived enjoyable consequences. The perceived profits and loss from a social behavior are computed, and when a relationship is too costly it is dropped.
Vertical and Horizontal Relationships	In some cultures hierarchy is very important, and in-group authorities determine most social behavior. In other cultures social behavior is more egalitarian.

The general issue is this: The term culture connotes so much that simply finding differences among individuals from one culture to another and attributing those differences to "culture" is a fairly empty statement (Atran, Medin, & Ross, 2005; Varnum, Grossman, Kitayama, & Nisbett, 2010). Instead, the goal is to "unpack" the term and to try to determine which aspects or dimensions of a culture contribute to the differences found. For example, might differences in counting skill be attributed to different uses of number within a culture? Might differences in perception have to do with the typical landscapes encountered by participants of different cultures? What, specifically, within the culture affects the ways in which people acquire, store, and process information?

Bovet's (1974) research addressed these questions by comparing the performance of children and adults from Algeria and Geneva, Switzerland, on Piagetian tasks of cognitive development. Bovet found some unusual patterns of results among her Algerian participants that she was able to relate to specific features of the Algerian culture. For example, Algerian children had a difficult time with the conservation of quantities. Bovet speculated that some of their difficulty reflected their everyday environment and customs:

> A further point to be mentioned is that eating and cooking utensils (bowls, glasses, plates) of the particular environment studied were of all shapes and sizes, which makes it somewhat difficult to make any comparisons of dimensions. Furthermore, the way of serving food at table was for each person to help from a communal dish, rather than for one person to share it out amongst those present; no comparison of the size of the portions takes place. Finally, the attitude of the mother who does not use any measuring instrument, but "knows" how much to use by means of intuitive approximations and estimations, may have some influence on the child's attitude. Thus, adult modes of thought can influence the development of notions of conservation of quantity in the child by means of familiar types of activities, in which the child participates, even if only as spectator. (p. 331)

Bovet (1974) asserted that aspects of the culture, physical (the shapes and dimensions of eating utensils) as well as behavioral (the practices surrounding the serving of food),

■ Photo 14.1 and 14.2: (1) An American family eating dinner and (2) a family from another culture eating dinner. According to Bovet (1974), even an ordinary setting, such as the dinner table, can affect certain cognitive processing, such as concepts of measurement.

guide and constrain the assumptions and questions children naturally have about quantities. Contrast her description of Algerian culture with your impressions of middle-class North American culture: Dinner tables are set such that everyone has the same kind of glass, spoon, plate, and so on. A parent serves each child with roughly the same serving size (perhaps affected by the age or size of the child). Disputes about who "got more" (of, say, an appealing dessert) are common. All these factors might help, in subtle ways, to focus attention on quantities and how quantities relate to such things as container shape and perceptual appearance. This focus, in turn, might help performance on later tests of conservation. Of course, these assertions warrant more rigorous testing before we can accept them. Other aspects of the culture might produce the effect; without empirical testing, we can't be sure.

More recently, social psychologist Richard Nisbett and his colleagues have been investigating differences in cognitive processing by East Asian residents (for example, of Japan, China, Korea) and comparing this to cognitive processing of Western European and North American (primarily US) residents. These researchers hold that East Asians typically process information more holistically and more contextually, whereas Westerners process information more analytically (Ji, Peng, & Nisbett, 2000; Miyamoto, Nisbett, & Masuda, 2006; Nisbett & Norenzayan, 2002; Nisbett, Peng, Choi, & Norenzayan, 2001; Varnum et al., 2010).

A fundamental question raised by cross-cultural research is the degree to which practices, beliefs, competences, and capacities are culturally relative or culturally universal. To assert that a cognitive process is culturally relative is to assert that the process is specific to a particular culture or set of cultures (Poortinga & Malpass, 1986). For example, the ability to form hierarchically organized categories (e.g., poodles are dogs, which are mammals, which are animals, which are living things) may be much more relevant to people in some cultures than in others (Greenfield, 2005). Cultural universality, by contrast, refers to phenomena believed common to humankind, such as the use of language.

The answer to this question profoundly affects the way in which research questions are framed. If, for instance, a process, capacity, or strategy is assumed to be universal, then cross-cultural questions about it are likely to ask how cultural factors influence and shape it. The assumption here is that the process, capacity, or strategy exists in all cultures but that culture (or some aspect of culture) can facilitate, hinder, or otherwise alter the way it is expressed.

In contrast, people who hold a position of cultural relativism, especially radical cultural relativism (Berry, 1981, 1984), would *not* assume that the process, capacity, or strategy is necessarily present in all cultures. Moreover, they would be less likely to view culture as the sum of several independent factors. Instead, these researchers believe that culture is a kind of Gestalt that cannot be broken into pieces. Certain concepts, processes, capacities, and the like are thus relevant to, and therefore found in, only certain cultures. The kinds of theories and explanations of cognition offered are therefore necessarily different for all (or at least many) cultures.

Cross-cultural researchers face many methodological challenges that do not play as large a role in the research programs of researchers who operate strictly within one culture (such as most of the work described in Chapters 2 through 13). You may recall from introductory psychology that a true experiment involves

(a) random assignment of participants to experimental conditions, (b) control over experimental treatments (that is, manipulation of independent variables), and (c) control over other confounding factors or events. Any experimenter has a difficult (if not impossible) task in achieving such control, but a cross-cultural researcher, in principle, can never achieve the first criterion (people cannot be randomly assigned to a culture either practically or ethically) and can probably never in reality achieve the second or third. After all, especially if certain tasks are more relevant to some cultures than others, it is nearly impossible to choose experimental tasks (such as memory tests and problem-solving tests) that are equally difficult and familiar, and equally a good measure of the aspect of behavior or ability under study, for people from different cultures (Malpass & Poortinga, 1986). For a variety of reasons unrelated to cognitive abilities, people from cultures in which the task is more familiar might outperform people from cultures in which the task is less familiar. Perhaps people from the former culture have had more practice with the task, or feel more comfortable with the task, or enjoy the task more. We will provide specific illustrations of this point.

By the way, you might have noticed that the inability to randomly assign people to cultures is a problem equivalent to the one faced by researchers studying gender, developmental, or other individual differences (L. G. Conway et al., 2001). So-called participant variables, such as age, gender, culture, and ethnic origin, are variables that a researcher cannot assign; this makes interpretation of experimental results all the more tricky.

Another problem in conducting cross-cultural research is that individuals within a culture may not take any note of or evaluate that culture (Kitayama, 2002). Cultural practices, such as daily routines, rituals, practices, styles of dress, and mannerisms, may be both tacit and implicit—widely shared within the culture and hence frequently unnoticed or regarded as unremarkable. As Kitayama puts it, "What culture is to humans, water is to fish" (p. 90).

In the last section of the chapter, we will examine research in the cross-cultural tradition carried out in the United States. Specifically, we will look at how people's performance works on everyday (that is, nonlaboratory, and often nonschool) cognitive tasks. One important question will serve as our focus: How well do theories and models of cognition, such as those described in earlier chapters, account for cognition "in the real world"? Much of the work reviewed in this chapter demonstrates that people's performance often displays context sensitivity; that is, it varies according to the task, the instructions, or other features of the environment.

EXAMPLES OF STUDIES OF CROSS-CULTURAL COGNITION

In this section, we will review a selection of cross-cultural cognition studies. As in the two previous chapters, it is impossible to examine each facet of human cognition cross-culturally. Instead, we will examine a very small sample of studies of cognitive capacities and processes from a cross-cultural point of view.

CROSS-CULTURAL STUDIES OF PERCEPTION

You may recall from Chapter 3 that the term *perception* refers to the interpretation of sensory stimuli—for example, using the information from your retinal image to see an object against a background or recognizing the furry creature meandering toward you as your cat. Because our perceptions typically occur quickly and effortlessly, it is tempting to conclude that perception is a built-in, hard-wired consequence of the way our sensory systems work. However, some landmark studies from cross-cultural psychology have directly challenged this assumption, showing that, quite literally, people from different cultures often "see things" quite differently. What follows below are good illustrations of the kind of top-down processing we talked about in Chapter 3.

Picture Perception

Studies by Hudson (1960, 1967) demonstrated that people from different cultures frequently do not see eye to eye. Hudson began with the intuition that Bantu workers in South African mines and factories seemed to have difficulty interpreting posters and films. To investigate why, he presented a variety of South Africans (both black and white, schooled and unschooled) with pictures such as those shown in Figure 14.1. Notice that all the pictures depict an elephant, an antelope, a tree, and a man holding a spear. The cards differ in the depth cues presented. Card 1 uses object size (objects farther away are rendered smaller). Cards 2 and 3 also use superposition (nearer objects partially occlude farther objects). Card 4 uses all these cues and, in addition, some cues of linear perspective (lines that are parallel appear to meet in the distance; other outlines or contours are scaled to fit in this framework). Participants were asked to describe what they saw, what they thought the figures in the pictures were doing, and which pairs of figures were closest to each other.

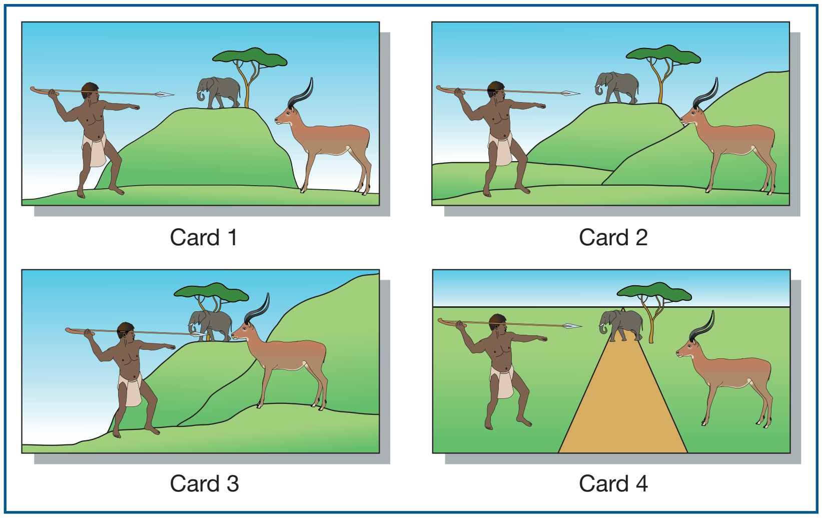
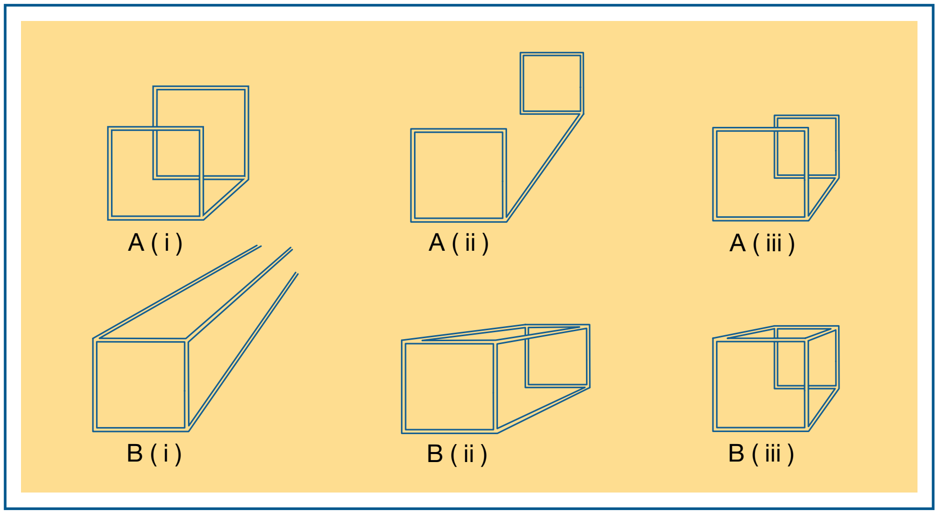


Figure 14.1: Stimuli from Hudson (1960).

Results showed that participants attending school typically came to a three-dimensional interpretation of the pictures (for example, seeing the man aiming the spear at the antelope, not the elephant; seeing the elephant as far away rather than very small). However, nonliterate workers, both black and white, typically "saw" the pictures two-dimensionally. Hudson (1960) argued that the cause of perceiving pictures three-dimensionally is not schooling per se but rather informal instruction and habitual exposure to pictures. He believed that such factors as exposure to pictures, photographs, and other illustrations in books and magazines available in the home provide a great deal of crucial, informal practice in "pictorial literacy." His speculation was based on the observation that schools provide little formal instruction in interpreting pictures, coupled with the observation that even the schooled black workers had greater difficulty than schooled white workers coming to three-dimensional pictorial interpretations.

Deregowski (1968), studying children and adult workers in Zambia, Central Africa, considered a different possibility. He wondered whether cross-cultural differences in pictorial perception really existed or whether some feature of Hudson's tasks caused participants to respond as if they couldn't interpret the pictures three-dimensionally. In one study, he gave participants two tasks: a version of the Hudson task and a task requiring them to make models from pictured depictions (such as those shown in Figure 14.2) out of sticks.

Deregowski (1980) found that although more than 80% of the participants failed to perceive the Hudson pictures three-dimensionally, more than half constructed three- rather than two-dimensional models. Deregowski argued, among other things, that perhaps his task and Hudson's differed in difficulty, with Hudson's requiring a more



■ Figure 14.2: Stimuli from Deregowski (1968).

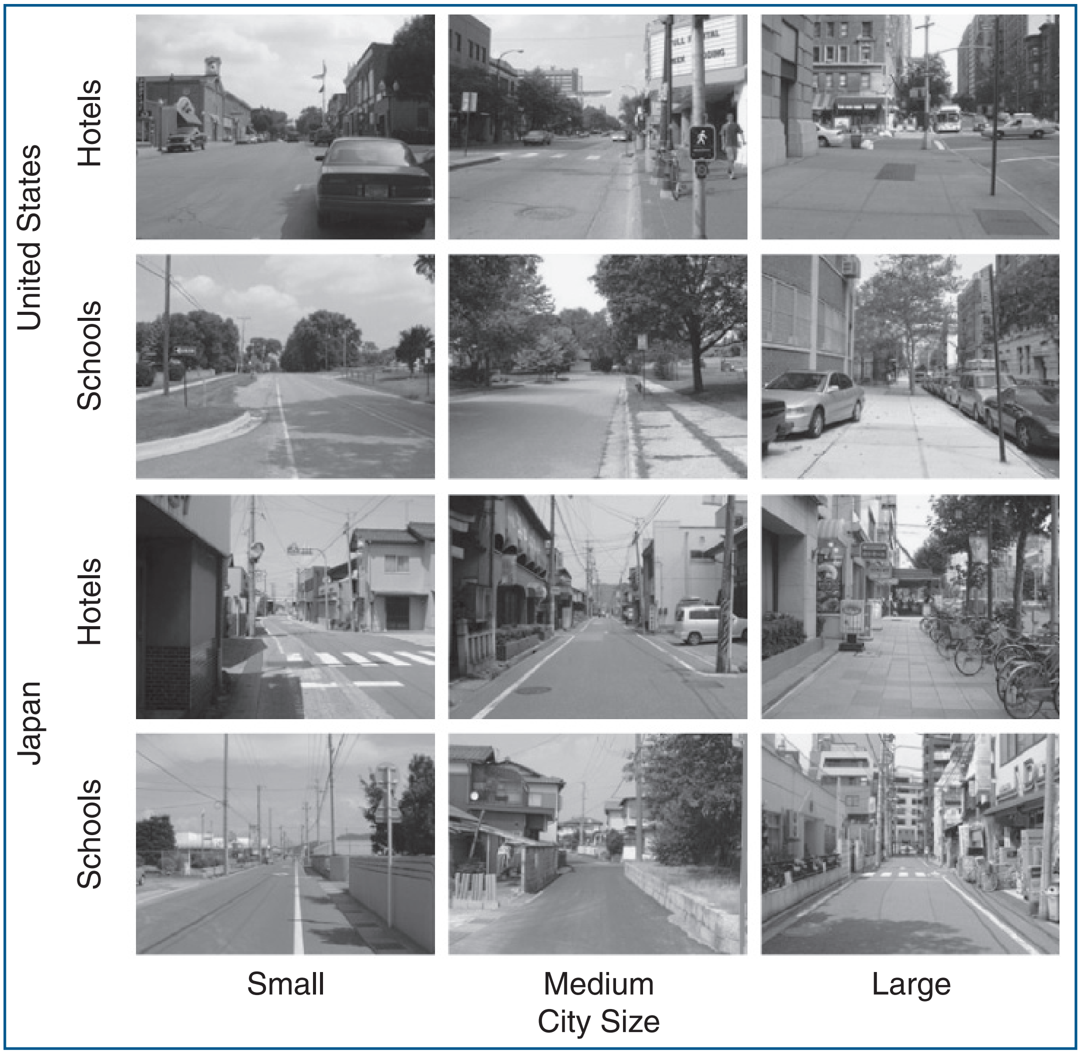
demanding response. For instance, perhaps the building task provides more guidance for the visual inspection of the picture, thus providing more cues to participants as to the "correct" interpretations.

Cole and Scribner (1974) concluded from these and other studies that it is too simplistic to conclude that people either can or cannot perceive pictures three-dimensionally. The issue, they argued, is when and how people come to interpret a two-dimensional stimulus as having depth. Perhaps the content of the pictures (depictions of people and animals or depictions of abstract geometric forms) influences perception. Perhaps the mode of response (answering a question, building a model) influences the way people perceive pictures. Whatever the reasons, this work suggested that the ways in which people view and interpret two-dimensional pictures depicting three-dimensional scenes are not necessarily the same from culture to culture.

This point was amplified and extended in a study by Liddell (1997). She showed South African children in Grades 1, 2, and 3 various color pictures of people and scenes of African origin. Children were asked to examine pictures and to "tell [the tester] what you see in the picture." These commentaries, which were probed for completeness by familiar testers, were later coded for the number of labels a child provided (for example, "That's a flower," "That's a hat"), the number of links a child made between items in the picture (for example, "The table is in front of the lady"), and the number of narratives or interpretations of the picture the child made (such as "The mother is putting the child to bed").

In response to the total six-picture series given to each child, children averaged 65 labels, 23 links, and 3 narratives. In other words, rather than "interpreting" the pictures, these South African children tended instead to provide factual, even disembodied, pieces of information about them. Moreover, the tendency to provide interpretations *decreased* as a function of years of schooling, with Grade 3 children providing fewer than Grade 1 or 2 children. Liddell (1997) contrasted this finding with one obtained from a sample of British children, who showed increases in narratives as a function of years of schooling. She suggested that the explanation for the difference may lie in the South African system of elementary education, which emphasizes factual and descriptive lessons (as opposed to open-ended or creative ones). Alternatively (or additionally), maybe the paucity of picture books and early readers in most rural African homes precludes these children's complete acquisition of learning to decode or interpret pictures.

Another recent study of photograph perception also makes some very interesting points about cross-cultural differences in perception. Miyamoto et al. (2006) began by taking photographs in three US cities of various sizes (New York; Ann Arbor, Michigan; Chelsea, Michigan) along with three comparable cities in Japan (Tokyo, Hikone, Torahime). The authors went to schools, post offices, and hotels in each city and took photographs from the streets surrounding the buildings. Sample photos are presented in Figure 14.3.

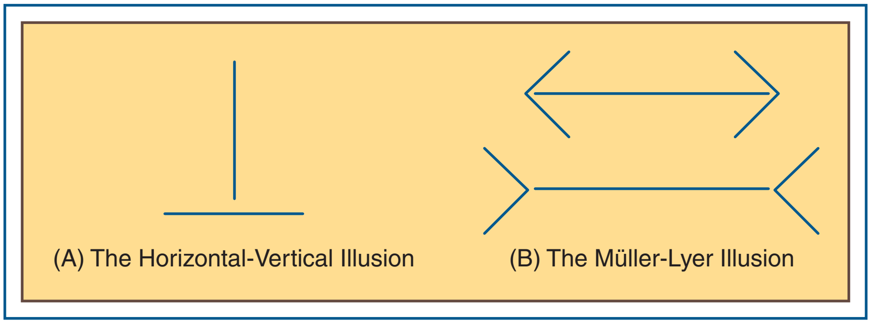


■ Figure 14.3: Examples of the pictures taken in front of US and Japanese schools and hotels used in Miyamoto et al. (2006).

The authors then had both Japanese and American participants (college students) rate each photograph on a number of dimensions, including the number of objects in each photograph, the degree to which the photograph seemed chaotic or organized, and how ambiguous or clear the boundaries between objects were. They also created objective measures of the scenes, using computerized image-recognition software. Their results showed that the photographs taken in Japan were more ambiguous and contained more elements (objects) than did American ones. They speculate that Japanese scenes may encourage more perception of context than do American scenes. This in turn could explain why, for example, in another of their studies, their American participants in a change blindness task (see Chapter 4) noticed more changes in the focal objects, whereas Japanese participants were more sensitive to changes in "background" or contextual objects (Masuda & Nisbett, 2006). Varnum et al. (2010) present arguments that these cognitive differences stem from differences in social orientation, with Americans being more likely to endorse the value of independence and Japanese tending to respect the social value of interdependence.

Visual Illusions

Other cross-cultural studies of perception have centered on visual illusions, such as those depicted in Figure 14.4. Rivers (1905) studied aspects of visual perception of people from the Torres Straits (Papuans from New Guinea) and people from southern India (the Todas). Rivers reported that relative to Western samples, the people he worked with were more prone to the horizontal–vertical illusion, in which a vertical line appears longer than the horizontal line it bisects even though both are the same length. However, his participants were less prone than Westerners to the Müller-Lyer illusion, in which a line with an arrow "tail" on both ends is perceived as being longer than a line with an arrow "head" on both ends even though both lines are the same length.



■ Figure 14.4: Some visual illusions studied cross-culturally.

Segall, Campbell, and Herskovits (1966) followed up on this observation, conducting a now classic study. In it, they used the Müller-Lyer and the horizontal–vertical illusions (refer to Figure 14.4) and worked with approximately 2,000 people from 14 African and Philippine locations and the United States. The investigators' hypothesis was that people's previous experience would affect their susceptibility to the illusions. In particular, Segall and colleagues believed that people who came from carpentered environments—characterized by wood or other materials arranged in straight lines, rectangular shapes, and other such geometric relationships—would be relatively more susceptible to the Müller-Lyer illusion. The idea here was that carpentered environments provide the people who live in them with a great deal of practice seeing rectangular shapes (boards, houses, windows) and therefore certain angles and junctions. The Müller-Lyer illusion taps into this experience as follows:

> Among persons raised in a carpentered world there would be a tendency to perceive the Müller-Lyer figure . . . as a representation of three-dimensional objects extended in space. In this instance the two main parts of the drawing represent two objects. On the [top of Figure 14.4(B)], for example, if the horizontal segment were perceived as the representation of the edge of a box, it would be a front edge; while on the [bottom], if the horizontal segment were perceived as the edge of another box, it would be the back edge along the inside of the box. Hence, the [top] horizontal would "have to be" shorter than the drawing makes it out, and the [bottom] horizontal would "have to be" longer. (Segall et al., 1966, pp. 85–86)

This argument is based on one offered by the psychologist Egon Brunswik (1956): People interpret cues in any situation according to the ways in which they have interpreted such cues in the past. People do this because in the past they have typically been correct in the way they have interpreted these cues. However, in certain situations, cues can be misleading and can cause people to make false interpretations.

Using analogous reasoning, Segall et al. (1966) predicted that people from cultures where the horizon is a part of the everyday landscape (such as desert or plains dwellers) would be more susceptible to the horizontal–vertical illusion than would people from cultures where the environment does not afford opportunities to view vast distances (such as jungle dwellers).

Segall et al. (1966) explained the task carefully to all participants, taking many methodological precautions to make sure they understood each task and had opportunities to respond to several versions of each illusion. On each trial, participants were presented with a stimulus pair containing two lines (sometimes consisting of illusions, sometimes consisting of other pairs of lines that produce no illusion) and had to indicate which line was longer. In general, the results confirmed the predictions just described, although both illusions were present in all cultures to a greater or a lesser degree. Despite some later disagreements over the findings by other investigators (see Deregowski, 1980, 1989, for reviews), Segall (1979) maintained that

■ Photo 14.3: Segall and colleagues (1966) predicted that people from cultures in which the horizon figures prominently in the landscape will show increased susceptibility to the horizontal–vertical illusion.

> people perceive in ways that are shaped by the inferences they have learned to make in order to function most effectively in the particular ecological settings in which they live. The generalization that we can derive . . . is that we learn to perceive in the ways that we need to perceive. In that sense, environment and culture shape our perceptual habits. (p. 93)

Notice that the issue being discussed has to do with perception, or how people interpret their sensory information, and not sensation, which is the acquisition of information. That is, no one claims there are cross-cultural differences in the way the visual (or auditory or olfactory) system works; rather they claim that differences may reside in the stages of cognitive processing that follow the initial acquisition of the information. To put it another way, the claim is made that culture affects the way people interpret sensory information to create meaningful interpretations of what they see.

CROSS-CULTURAL STUDIES OF MEMORY

Like perception, memory is widely regarded as a process central to almost every other form of cognition. Clearly, all people need a means of storing some of the information they encounter for possible later use. Thus, it seems reasonable to believe that memory should show many commonalities across cultures. In this section, we will examine some of the work on memory carried out with people of non-Western cultures.

Free Recall

Given the assumptions just stated, results from studies carried out with the Kpelle people of Liberia, Africa, were surprising (Cole, Gay, Glick, & Sharp, 1971). As one part of a long series of studies on Kpelle cognition, Cole et al. administered a free-recall task. They read participants a list of nouns (all having been demonstrated to

Table 14.2: Stimuli Used by Cole et al. (1971)

Clusterable	Nonclusterable
Plate	Bottle
Calabash	Nickel
Pot	Chicken feather
Pan	Box
Cup	Battery
	Animal horn
Potato	Stone
Onion	Book
Banana	Candle
Orange	Cotton
Coconut	Hard mat
	Rope
Cutlass	Nail
Hoe	Cigarette
Knife	Stick
File	Grass
Hammer	Pot
	Knife
Trousers	Orange
Singlet	Shirt
Headtie	
Shirt	
Hat	

SOURCE: Cole and Scribner (1974, p. 127).

refer to familiar objects). One set of lists (see Table 14.2) consisted of items that "clustered" into different categories (such as tools, articles of clothing); another set consisted of the same number and types of items but had no apparent clusters. Previous work using educated residents of the United States had shown that people's free-recall performance is enhanced when they are given clustered lists relative to nonclustered lists, especially when the items are presented in blocks, with all items from the same category presented together (Bousfield, 1953; Cofer, 1967).

Kpelle children (ranging in age from 6 to 14) and adults participated. Of the children, some were in school (first through fourth grades), and some were not; all the adults were schooled. The performance of the participants was compared with that of white, middle-class children from southern California.

Cole and colleagues (1971) found large differences by age in their American sample, with older children recalling far more of the words on each list than younger children. Kpelle participants, however, showed only slight differences by age. Moreover, the schooled Kpelles did not outperform the nonschooled Kpelles by much of a margin. Although the clusterable lists were easier for all Kpelle and American samples, only the American participants displayed much clustering in their free recall. That is, regardless of how the items from the clusterable lists were presented, American children, especially those 10 years and older, were more likely to recall all the tools, then all the foods, and so on. The Kpelle participants, by contrast, were quite unlikely to do so.

It appeared, at first, as if the Kpelle had memory systems that worked differently than those of Americans. However, Cole et al. (1971) followed up this work by testing a number of rival hypotheses. Perhaps, for example, the Kpelle did not understand the task. Perhaps they were not very interested in the task and therefore did not try very hard. Perhaps the cues provided weren't clear enough. In a number of studies, the investigators gathered evidence against each of these.

In one series of studies, Cole et al. (1971) demonstrated that when the Kpelle were cued to recall items by category (for example, at the time of recall only, the experimenter said something like "Tell me all the clothing you remember. [S(ubject) responds.] Okay, now tell me all the tools you remember . . ."), their performance improved dramatically. This result (along with several others we don't have space here to review) suggested to Cole and Scribner (1974) that although the Kpelle may perform differently on a memory task, there is little evidence to support the view that memory systems function in qualitatively different ways than do American or Western European people's memory systems. In particular, Cole and Scribner argued:

> It appears that the cultural difference in memory performance tapped in the free-recall studies rests upon the fact that the more sophisticated (highly educated) subjects respond to the task by searching for and imposing a structure upon which to base their recall. Noneducated subjects are not likely to engage in such structure-imposing activity. When they do, or when the task itself gives structure to the material, cultural differences in performance are greatly reduced or eliminated. (p. 139)

We will return later to the effects of schooling, or years of formal education, particularly in Western-type schools, on cognition.

A more recent study (Gutchess et al., 2006) started from the premise that clustering is more common in Western cultures (e.g., in the United States) than Eastern ones (e.g., in China). The researchers gave free-recall tasks to both younger adults and elderly adults in both cultures, reasoning that clustering would be particularly difficult for elderly Eastern adults due to age-related cognitive limitations of the sort described in Chapter 13. Indeed, the authors found that while the groups from both cultures recalled about the same number of words, the extent of clustering was particularly different for Western versus Eastern elderly adults.

Visuospatial Memory

One criticism often raised about exporting traditional, laboratory-based experiments to other cultures is that the tasks themselves vary in familiarity, importance, and general level of interest to people from different cultures. If true, the charge raises serious problems for any cross-cultural research comparing the performance of people from different cultures on the same task. If experimental tasks are not closely derived from tasks that people normally engage in during their daily lives, people's performance will not be particularly informative with regard to their real abilities.

Many investigators, taking the criticism seriously, have tried to design studies that closely model real-life tasks. In one such study, Kearins (1981), studying visuospatial memory in desert Australian Aboriginal children and adolescents, presented participants with tasks in which they viewed arrays of objects for 30 seconds and then, after the objects were scrambled, reconstructed the arrays. Kearins's rationale was this: Traditional desert living requires a great deal of movement among widely spaced sites, many of which are "visually unremarkable." For various reasons having to do with unpredictable rainfall and the requirements of hunting and other food gathering, the routes between sites are rarely duplicated exactly. Presumably, this requires kinds of spatial knowledge other than route knowledge. One possibility is a greater ability to remember spatial relationships:

> Memory for a single environmental feature would be unlikely to have been a reliable identifier of any particular spot, both because outstanding features are rare in this region of many recurring features, and because of the need for approach from any direction. But particular spatial relationships between several features could uniquely specify a location, more or less regardless of orientation. Accurate memory for such relationships is thus likely to have been of considerable value both in movement between water sources and in daily foraging movements from a base camp. (p. 438)

Kearins (1981) presented both Aboriginal and white Australian children with four conditions. In each one, they saw a collection of 20 familiar objects. In two of the conditions, the objects were human-made artifacts (such as a knife or a thimble); in the other two, the objects were naturally occurring objects (such as a feather or a rock). In two of the conditions, all the objects were of the same type (such as all rocks or all bottles); in the other two, they were of different types (such as a knife, an eraser, a thimble). Testing took place on benches in playgrounds or under trees, and care was taken to minimize the "testlike" nature of the task. Children viewed each array for 30 seconds, then closed their eyes while the objects were jumbled in a heap, and then were asked to reconstruct the array with no time limit.

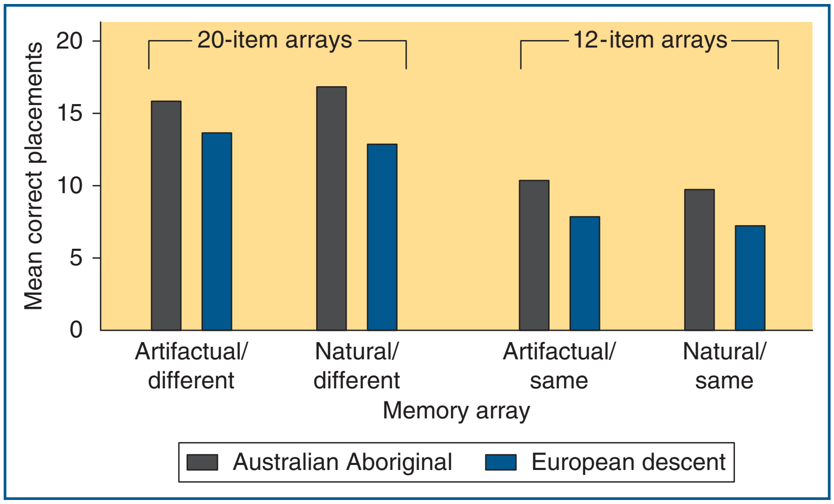


Figure 14.5: Results from Kearins (1981).

Results, shown in Figure 14.5, revealed that Aboriginal adolescents outperformed their white age-mates in every condition. Kearins (1981) commented that the task seemed almost too easy for the Aboriginal children: A significant portion (ranging from 14% to 54% in different conditions, compared to an average of 4.5% for the white children) made no errors.

Observation of the Aboriginal participants revealed that they tended to sit very still while viewing arrays and did not show any evidence of rehearsal. White children and adolescents were much more likely to move around in their seats, to pick up objects, and to "mutter." In the reconstruction phase, Aboriginal children placed objects at a steady, deliberate pace and made few changes as they worked. White Australian children began the reconstruction phase "in great haste" and subsequently made many changes in where the objects were placed. Kearins (1981) believed the Aboriginal children were using a visual strategy; white children, a verbal strategy. When asked how they were performing the task, Aboriginal children tended to shrug or to say they remembered the "look" of the array; white Australians tended to describe verbal rehearsal strategies at length.

Kearins (1981) took the data from this and other experiments as supporting her idea that culture can impose "environmental pressure" selectively to enhance certain cognitive skills—in this case, visual rehearsal strategies. She further believed that once a certain skill is established, individuals are more likely to practice it, thus possibly enhancing the skill. Moreover, cognitive (and other) skills and habits useful within a culture are likely to be encouraged by parents and other adults from a child's early years. As a result, certain cognitive abilities become more prevalent and are better performed.

CROSS-CULTURAL STUDIES OF CATEGORIZATION

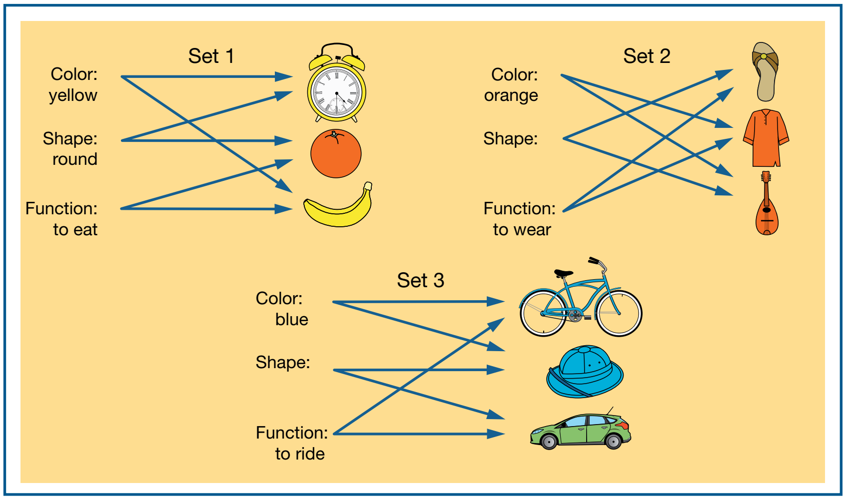
Imagine walking into a room and seeing a number of blocks of various sizes. On one side of each is painted a small, medium, or large circle, square, or triangle that is red or yellow or red-and-yellow striped. Imagine being asked to "put the ones together that go together," a vague instruction that asks you to classify. You can see immediately, I hope, that there are several ways of sorting the blocks: by painted shape, by block size, or by marking. We could observe your performance, and we could ask two questions about it: On what basis do you classify the blocks, and how consistent are you in using this basis?

According to psychologist Jerome Bruner (Bruner et al., 1966), the way we carry out classification tasks changes with development. At first, we tend to use perceptual bases for classification, especially color (Olver & Hornsby, 1966). Later, the basis of our sorting (when more meaningful objects, as opposed to blocks, are used) becomes less perceptual and more "deep," as we start to group objects together on the basis of function rather than form. So whereas a young child might group a carrot and a stick in one set and a tomato and a ball in another (paying attention to shape), an older child might be expected to group the two foods and the two artifacts. Moreover, children's ability to sort objects consistently, using whatever basis they choose, also increases with development, as we saw in Chapter 12.

Patricia Greenfield, a collaborator of Bruner's, carried out similar studies with unschooled Wolof children in rural Senegal, West Africa (Greenfield, Reich, & Olver, 1966). Children (ages 6 to 16) saw 10 familiar objects, 4 of which were red, 4 of which were items of clothing, and 4 of which were round (some objects had two or more of these properties). They were told to choose the objects that were "alike" and then to say how they were alike.

The question was "Did children use any of these bases in a systematic way, selecting all and only the red objects, all and only the round objects, or all and only the articles of clothing?" Most of the Wolof children (typically over 65%) selected items on the basis of color, but they showed great improvement with age in their ability to do so systematically. At age 6 or 7, only about 10% systematically selected all and only the four red objects; at age 9, about 30%; and by age 15, close to 100%.

In a second study with schooled and unschooled Wolof children (ages 6 to 13) and unschooled adults, Greenfield et al. (1966) presented sets of three pictured objects. Within each set, two objects shared a color; two, a shape; and two, a function. Figure 14.6 provides some examples. Participants were asked to show which two of the three objects in each set were "most alike" and to explain why.



■ Figure 14.6: Stimuli used by Greenfield et al. (1966).

Greenfield et al. (1966) examined the bases on which children and adults grouped items. Schooling was found to have a very powerful effect. First, unschooled participants had more trouble interpreting the pictures and recognizing the depicted objects, a finding consistent with those reported by Hudson (1960), discussed earlier. Second, children who had attended school were much less likely to use color as a classification basis, and the decrease in preference for color was associated with years of schooling. Conversely, sorting on the basis of form and of function both rose with years of schooling. In fact, the use of either form or function as a basis for sorting was "virtually nonexistent" for unschooled participants (Greenfield et al., p. 295). In general, the authors concluded that "schooling appears to be the single most powerful factor we have found in the stimulation of abstraction" (p. 315).

Sharp and Cole, working with Mayan people in Yucatán, Mexico, wondered whether a preference for grouping by color necessarily precluded other bases for grouping (Cole & Scribner, 1974). They presented participants (children in the first, third, and sixth grades and adolescents with 3 or fewer years of school) with cards depicting various geometric figures that varied in color, shape, and number (such as one circle, two circles). After the participants had sorted the cards, the experimenters asked them to re-sort the cards on another dimension. The results showed, first, that the percentage of participants able to sort consistently on the basis of color, shape, or number rose dramatically with years of schooling. Second, the ability to reclassify also depended on schooling: First graders were almost completely unable to reclassify, and fewer than half of the third graders and adolescents (with 3 or fewer years of schooling) could reclassify. Of the sixth graders, 60% were able to re-sort, using a dimension different from that used in the first sorting.

Irwin and McLaughlin (1970) found another variable that affected performance on this task. They performed a similar experiment, using stimuli like those employed by Sharp and Cole as one condition and stimuli consisting of eight bowls of rice as another. Rice was a very familiar commodity to the study participants, Mano rice farmers in central Liberia. The bowls of rice differed in type of bowl (large or small) and type of rice (polished or not polished).

Results showed that although unschooled adults were not very able to re-sort either the cards or the bowls, all the participants, including the adults, were much more able to sort the rice than the cards quickly. In a later study, Irwin, Schafer, and Feiden (1974) worked with Mano farmers and American undergraduates. Both groups were given geometric shapes on cards (in one condition) and rice (in another condition) to sort. As expected, the Mano had trouble with the shapes but sorted the rice quite easily.

Conversely, the Americans did quite well sorting and re-sorting the shapes but were less adept at noticing all the possible bases for sorting the rice. Taken together with the earlier study, these results suggest that differential exposure to stimuli (presumably as a consequence of cultural setting) can have dramatic effects on even as supposedly basic a cognitive task as sorting.

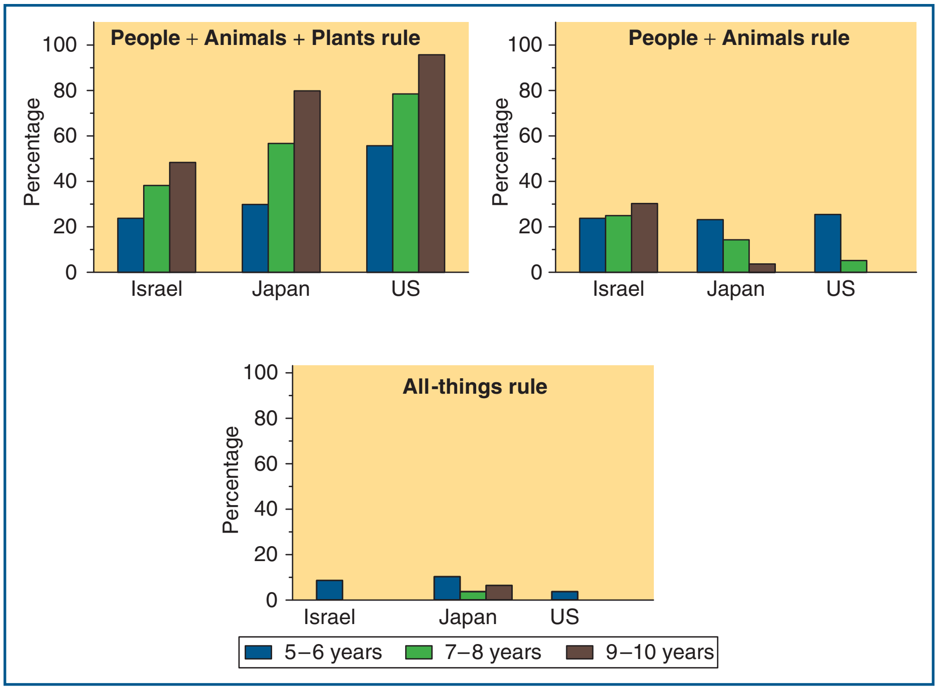
Hatano et al. (1993) extended this line of investigation when they examined concepts of being biologically alive with children from Japan, Israel, and the United States. Although all three countries, in the authors' words, are "highly developed and scientifically advanced," they differ in the ways their dominant cultures regard the relationship of plants to animals.

> Japanese culture includes a belief that plants are much like human beings. This attitude is represented by the Buddhist idea that even a tree or blade of grass has a mind. Many Japanese adults . . . view plants as having feelings and emotions. Similarly, even inanimate entities are sometimes considered to have minds within Japanese folk psychology. (p. 50)

In contrast, "within Israeli traditions, plants are regarded as very different from humans and other animals in their life status" (p. 50).

Hatano et al. (1993) interviewed kindergartners and second and fourth graders in all three countries, asking them about whether people, other animals (a rabbit and a pigeon), plants (a tree and a tulip), and inanimate things (a stone and a chair) had various properties of animacy, such as whether they were alive; had things such as a heart, bones, or a brain; had sensory capacities to feel cold or pain; and could do things such as grow or die. The authors reported several interesting findings. One set concerned the "rules" that individual children seemed to be using. One rule, called the "people, animals, and plants" rule, meant that a child consistently judged these three things as being alive but inanimate things as not being alive. Another rule, the "people and animals" rule, involved judging only people and animals to be alive (not plants or inanimate things). The "all things" rule corresponded to consistent judgments that all things asked about, including the stone and chair, were alive.

Figure 14.7 presents some of the results. More children in the United States used the "people, animals, and plants" rule, and this pattern held for every age group tested. Children from Israel were more likely than children in either other country to deny that plants were alive (that is, to use the "people and animals" rule). The authors speculated that children's television programming in the United States may account for the apparent superiority of biological knowledge among children from the United States. They argued that various nature shows, magazines, and picture books are more common in the United States than in Japan or Israel and that these may be an influential determinant of children's conceptual knowledge, especially among kindergartners. Of course, this is not the only possible explanation, and it warrants further investigation.



■ Figure 14.7: Percentage of children who adopted each rule regarding the classification of various entities as animate (Hatano, 1993).

Taken together, the studies reviewed in this section suggest that using familiar materials helps to uncover cognitive competence, a principle discussed originally in Chapter 12. Once again, the results described here provide reasons for caution in interpreting cognitive abilities, especially cross-culturally. People tend to believe there is only one (or only one correct) way of processing information in a cognitive task. The results of the several studies described in this chapter remind us that people may have considerably more flexibility in their cognitive processing and that the ways they approach a task depend on the context, the instructions, and even the stimulus materials.

CROSS-CULTURAL STUDIES OF REASONING

We saw in Chapter 11 that formal reasoning involves drawing conclusions based solely on the given information, or premises. Many psychologists and philosophers have assumed that such processing underlies the kinds of reasoning and thinking that occur frequently—that problems such as "All men are mortal; Socrates is a man; (therefore) Socrates is mortal," are basic and therefore rather easy to deal with.

A. R. Luria (1976), a student of the Soviet psychologist Lev Vygotsky, examined how farmers living in Central Asia, some literate and some not, approached such verbal syllogisms. Some of the syllogisms had familiar, practical content but required the participant to apply a familiar principle to a new environment. Here is an example: "Cotton grows where it is hot and humid. England is cold and damp. Can cotton grow there or not?" Another example: "In the Far North, where there is snow, all bears are white. Novaya Zemlya is in the Far North. What color are the bears there?"

The responses to these syllogisms depended on the background of the farmers. Those with no schooling simply refused to deal with the problem, typically responding something like "I don't know; I've seen a black bear, I've never seen any others. . . . Each locality has its own animals; if it's white, they will be white; if it's yellow, they will be yellow," or "How should I know?" (Luria, 1976, pp. 109–110). One respondent, a nonliterate 37-year-old resident of a remote village, summed up the problem: "We always speak only of what we see; we don't talk about what we haven't seen." When the experimenter asked, "But what do my words imply?" and repeated the syllogism, the villager responded,

> Well, it's like this: Our tsar isn't like yours, and yours isn't like ours. Your words can be answered only by someone who was there, and if a person wasn't there he can't say anything on the basis of your words. (p. 109)

Nonliterate villagers faced three limitations, according to Luria (1976). First, they had difficulty accepting (even for the sake of argument) initial premises that contradicted their own experience. Often such premises were dismissed and forgotten. Second, nonliterate villagers refused to treat general premises (such as "In the Far North, all bears are white") as truly general. Instead, they treated these statements as descriptions particular to one person's experience and again often ignored the premise in their reasoning. Third, those lacking literacy tended not to see the various premises as parts of a single problem but rather treated all the premises as independent pieces of information. The farmers who had participated in a literacy program, by contrast, accepted the fact that conclusions could be drawn not just from their own knowledge but from the problem (premises) itself and drew the correct conclusion.

However, looked at from another point of view, these villagers could be seen as reasoning logically, albeit with very different premises. In effect, their argument could be construed as follows: "If I had firsthand knowledge of a black bear, I could answer the question. I don't have firsthand knowledge; therefore, I cannot answer the question." Cole and Scribner (1974) reported similar results with reasoning tasks given to Kpelle tribespeople from Liberia. The following is an example:

EXPERIMENTER (LOCAL KPELLE MAN):	At one time spider went to a feast. He was told to answer this question before he could eat any of the food. The question is: Spider and black deer always eat together. Spider is eating. Is black deer eating?
SUBJECT (VILLAGE ELDER):	Were they in the bush?
EXPERIMENTER:	Yes.
SUBJECT:	Were they eating together?
EXPERIMENTER:	Spider and black deer always eat together. Spider is eating. Is black deer eating?
SUBJECT:	But I was not there. How can I answer such a question?
EXPERIMENTER:	Can't you answer it? Even if you were not there, you can answer it. (Repeats question)

SUBJECT: Oh, oh, black deer is eating.

EXPERIMENTER: What is your reason for saying that black deer is eating?

SUBJECT: The reason is that black deer always walks about all day eating green leaves in the bush. Then he rests for a while and gets up again to eat. (p. 162)

Notice a few things here. First, the participant avoids answering the question, asserting that his lack of personal knowledge or experience prevents him from knowing the answer. His assumption is that questions can be answered based only on personal, firsthand knowledge. When pressed by the experimenter, the participant comes up with a response but again gives reasons that are based on his knowledge rather than on the premises of the syllogism itself. In Henle's (1962) terms, the participant has "failed to accept the logical task" (p. 370), refusing to draw conclusions based on (or based only on) the premises supplied by the experimenter.

Other participants in this study showed different ways of avoiding the task set for them by the experimenter. Some introduced new premises, usually ones that incorporated the participant's personal knowledge, so that a conclusion could be drawn and justified based on this knowledge. Research by Sylvia Scribner (Cole & Scribner, 1974) suggested that participants appeared to distort the syllogisms in memory, forgetting some premises and altering others, as this example shows:

PROBLEM: The chief's brother either gave him a goat or he gave him a chicken. The chief's brother did not give him a goat. Did he give him a chicken?

SUBJECT: Yes. I know he gave it to him.

(Subject is then asked to recall the problem): The chief's brother will give him a goat. If he does not give him a goat, he will give him a chicken.

EXPERIMENTER: What question did I ask?

SUBJECT: You asked me, is the chief's brother going to give him a goat?

EXPERIMENTER: (Reads problem again)

(Subject is asked to recall the problem): Yes. That is what you told me. The chief's brother will give him a goat. If he does not give him a goat, he will give him a chicken.

EXPERIMENTER: What question did I ask you?

SUBJECT: You asked me, the chief's brother will give him a goat. If he does not give him a goat, will he give him a chicken? (p. 165)

Notice here that the participant does not reproduce all the premises in the problem. On each recall, he omits the second premise, that the chief's brother did not give him a goat. Without this premise, the question cannot be answered, perhaps accounting for the fact that the participant continually has difficulty keeping in mind the question asked.

Apparently, then, one difficulty with syllogistic reasoning with nonliterate people is their inability or unwillingness to "remain within problem boundaries" (Cole & Scribner, 1974, p. 168). Instead, people tend to omit, add, or alter premises so that conclusions can be drawn from personal knowledge. It is worth pointing out that such errors are not unique to people from nonliterate cultures. As we saw in Chapter 12, young children have difficulty staying "within bounds" when working on a reasoning task. In addition, the tendency to alter, omit, or add premises to a syllogism occurs with adults in the United States as well, especially on difficult problems, as Henle (1962) argued. This in turn suggests that the reasoning of people from other cultures does seem similar in terms of basic processes and that what is difficult for people in one culture also seems to be difficult for people in others. The data also suggest that schooling or literacy improves people's formal reasoning abilities, something we will explore in greater depth later.

However, recent work by Nisbett and his colleagues has suggested that not all cross-cultural differences in reasoning can be explained in terms of exposure to formal schooling. For example, content effects in formal reasoning tasks were found to be greater for Koreans than for Americans (Norenzayan, Choi, & Nisbett, 2002). Chinese and Korean university students used more intuitive strategies of reasoning compared with European American university students, who relied more on formal reasoning strategies (Norenzayan, Smith, Kim, & Nisbett, 2002). Norenazyan and Nisbett (2000) believe this cross-cultural difference in reasoning may be a consequence of a more general cultural difference in holistic (East Asian) versus analytical processing of information, discussed earlier. Nisbett and Norenzayan (2002) believe that part of the explanation for cross-cultural differences may be industrialization but part may also be the Western traditions of adversarial debate, contractual relationships, and formalization of knowledge.

CROSS-CULTURAL STUDIES OF COUNTING

One of the most fascinating lines of cross-cultural cognitive research centers on the development of mathematical (usually arithmetical) knowledge and problem solving. If you think about it, the development and use of an arithmetical system is critical for many kinds of everyday activities in almost all cultures: buying, selling, making change, keeping inventories, determining relative amounts, and the like. It is of great interest to note that not all cultures have developed the same systems and to examine the ways in which the systems that exist have evolved.

Let us first examine the arithmetic skill of counting. Work by Rochel Gelman and Randy Gallistel (1978) with preschoolers in the United States demonstrated that even very young children in the United States know a great deal about counting. With small numbers (that is, less than about 5), even 2- and 3-year-olds can count the number of items in a set. But what does it mean to count? Gelman and Gallistel offered this surprisingly complicated definition:

> [Counting] involves the coordinated use of several components: noticing the items in an array one after another; pairing each noticed item with a number name; using a conventional list of number names in the conventional order; and recognizing that the last name used represents the numerosity of the array. (p. 73)

Gelman and her colleagues observed the counting behavior of preschoolers and were able to identify several distinct "principles" of counting. These are described in the following list:

1. *The one-one principle.* Each item in a to-be-counted array is "ticked" in such a way that one and only one distinct "tick" is assigned to each item.
2. *The stable-order principle.* The tags (count words) assigned to each item must be chosen in a repeatable order.
3. *The cardinal principle.* When one is counting an array, the final tag represents the number of items in the set.
4. *The abstraction principle.* Any group of items, whether physical or not, whether of the same type or not, can be counted.
5. *The order-irrelevance principle.* The order of enumeration (that is, which item is tagged "1," which "2," and so on) of items in a set does not affect the number of items in the set or the counting procedure.

A child might have some but not all of these principles at any stage of development. Nonetheless, even if her "counting" behavior doesn't exactly match that of an adult, she can be properly described as "counting" if her behavior shows evidence of honoring at least some of the principles. For example, a child aged 2 years and 6 months counted a plate containing three toy mice as follows: "One, two, six!" Asked by the experimenter to count the mice once again, the child happily complied: "Ya, one, two, six!" (Gelman & Gallistel, 1978, p. 91). This child showed clear evidence of respecting the one-one and the stable-order principles and therefore really was counting, even though she used a different count-word sequence than adults do.

Cross-cultural work by Geoffrey Saxe (1981; Saxe & Posner, 1983) provides evidence that counting systems vary in different cultures. Saxe reported studies of children in a remote Oksapmin village in Papua New Guinea. Unlike the base-10 system of numbers used in our culture, Saxe found that the Oksapmin developed a body-part counting system with no base structure. Instead, the Oksapmin label 27 distinct body parts on the hands, arms, shoulders, neck, and head. Just as we count on our fingers, the Oksapmin count not only fingers but arm, shoulder, neck, and head locations, looping back and adding prefixes when they need a number larger than 27. Figure 14.8 illustrates the Oksapmin counting system.

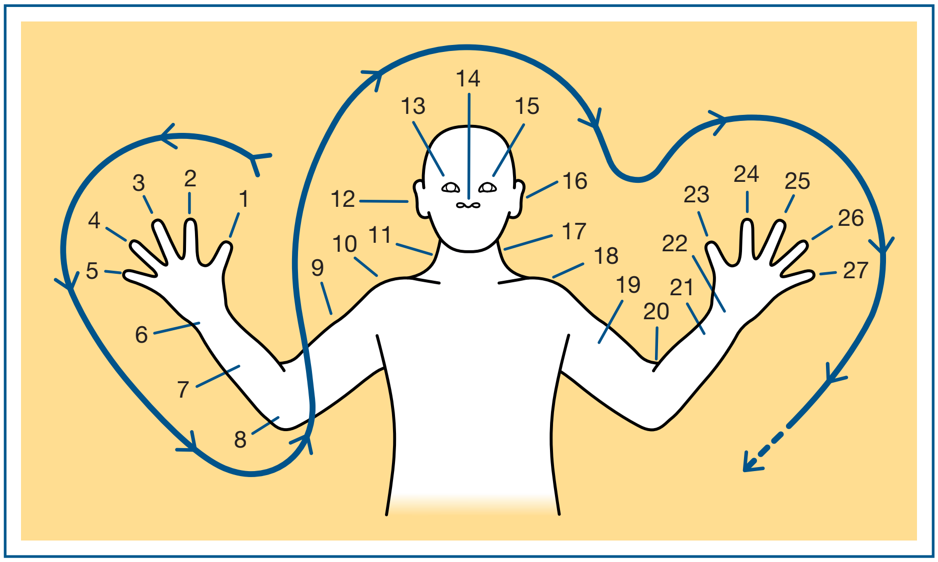
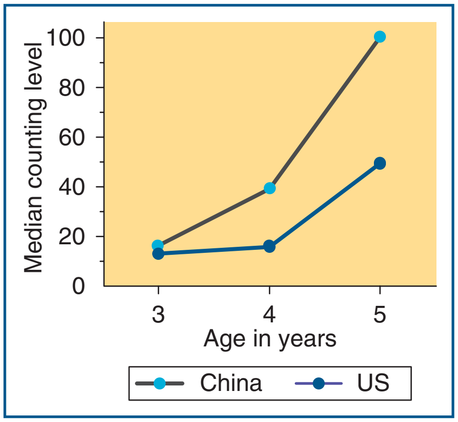


Figure 14.8: The Oksapmin counting system. The conventional sequence of body parts used by the Oksapmin, in order of occurrence: (1) tip^na, (2) tipnarip, (3) bumrip, (4) h^tdip, (5) h^th^ta, (6) dopa, (7) besa, (8) kir, (9) tow^t, (10) kata, (11) gwer, (12) nata, (13) kina, (14) aruma, (15) tan-kina, (16) tan-nata, (17) tan-gwer, (18) tan-kata, (19) tan-tow^t, (20) tan-bir, (21) tan-besa, (22) tan-dopa, (23) tan-tip^na, (24) tan-tipnarip, (25) tan-bumrip, (26) tan-h^tdip, (27) tan-h^th^ta.

One question that arose for Saxe and others was whether the existence of a "baseless" numeration system, as used by the Oksapmin, would change the understanding of certain numeric relations. For example, is a Piagetian number conservation task (see Chapter 12 if you need a review), which relies on understanding the concept of "more" or "less" than, much harder for Oksapmin children than for US children? Saxe (1981) found that although Oksapmin children generally develop counting and conservation concepts at later ages, their developmental pattern is quite similar to that of children in the United States. It is interesting that Oksapmin who participate frequently in a newly introduced money economy, which requires more arithmetic computation than does more traditional Oksapmin life, are changing and reorganizing their body-part numeration systems to make computation easier.

A more recent study bears on the issue of the base system and its relation to counting. K. F. Miller, Smith, Zhu, and Zhang (1995) asked preschool children from Champaign-Urbana, Illinois, and Beijing, China, to perform a variety of counting tasks. This comparison was interesting because Chinese and English differ in their naming conventions for numbers. Both have distinct and unpredictable names for the digits 1 through 10. That is, you cannot predict from knowing that the numeral 8 is named *eight* that the numeral 9 will be named *nine;* number names up through 10 are unordered.

However, for the second decade of numbers, the two languages diverge. Chinese uses a consistent base-10 system of naming: the name for 11 in Chinese translates literally to "ten one." In English, however, the names for 11 and 12 (*eleven* and *twelve*) do not make clear the relationship of these numbers to the numbers 1 and 2. After the number 20, the two languages name numbers in similar ways, although English throws in a few more twists than Chinese does (making 20 *twenty*, for instance). This led the investigators to predict that Chinese preschoolers would have an easier time learning to count, especially for numbers in the teens.



■ Figure 14.9: Median level of abstract counting (highest number reached) by age and language. Significant differences favoring Chinese-speaking children were found at ages 4 and 5 years, but not at age 3.

Children were given various counting tasks. For example, children were asked to count as high as possible and were prompted to continue by the experimenter whenever they stopped. The final number the child reached was regarded as his or her counting level. Figure 14.9 shows the median counting level for preschoolers of different ages. Although 3-year-olds from both countries reach about the same number, Chinese 4- and 5-year-olds can count significantly higher than can their American counterparts.

The investigators (K. F. Miller et al., 1995) also looked at whether there was a pattern of difference as to where children stopped counting. There were no differences in the percentage of children who could only count to a number below 10: The researchers found that 94% of American children and 92% of Chinese children all could count to this number. However, only 48% of American preschoolers could count to 20, in comparison with 74% of the Chinese preschoolers, a striking difference. This difference did not grow larger in succeeding decades, suggesting that counting breaks down for US children at the place where the languages differ in making clear the base-10 nature of the number system.

K. F. Miller et al. (1995) argues that such differences play a role in explaining why school-age children in China and Japan have been shown to outperform their same-age counterparts in the United States. Although many shortcomings in arithmetic instruction have been documented in the United States compared with that in some

Asian countries (Stevenson et al., 1990), Miller et al. assert that some of the problem traces back, at least in part, to fundamental differences in understanding the base-10 nature of the number system at the time when children enter school.

Recent cross-cultural work on numerical cognition examines how people from different cultures map numbers onto a "mental number line"—an internal representation of the way in which different numbers relate to one another, where shorter distances between two numbers depict a closer numerical relationship. Debates are ongoing as to whether or not the specifics of the mental representation are culturally relative or universal (Bender, 2011; Nuñez, 2011).

Throughout this section, we have seen examples of the ways in which cognitive tasks and performance can differ across different cultures. We have also seen that one important variable affecting a number of different cognitive tasks is schooling. In the next section, we will examine the effects of this variable more closely, trying to isolate just what aspects of schooling produce the effect.

EFFECTS OF SCHOOLING AND LITERACY

What is it about schooling that apparently produces such widespread changes in cognition? Is it something about the curriculum specifically, or do the changes result from a more global aspect of the context of going to school? These questions are just beginning to be addressed in the cross-cultural study of cognition.

One candidate for the source of schooling effects is **literacy**, the ability to read and write. Many psychological, linguistic, and anthropological scholars believe that literacy has profound effects on society (Scribner & Cole, 1981). One assertion is that literacy changes thought in fundamental ways. Scholars dating back to Plato and Socrates have wondered whether written language promotes logical and abstract thinking in a way that oral language does not and cannot (Scribner & Cole). Goody and Watt (1968) argued, for instance, that disciplines such as history and logic are impossible without written language. Writing a text allows a permanency that oral language does not. This permanency allows people to carry on certain processes that might be impossible otherwise—for example, comparing two sentences to look for implications or inconsistencies, or examining the internal structure or syntax of a sentence.

Lev Vygotsky, a noted Marxist psychologist, argued, as Marx had, that a human being's "nature" was actually the product of his or her interaction with the environment (Vygotsky, 1986). Thus, cognitive processes and capabilities are not simply the result of our biological heritage but rather the result of human–environment interaction, which changes and shapes not only the environment but also the nature of our cognition (Scribner & Cole, 1981).

At any given time, the tools available for a task change the ways in which the task is carried out. For example, the invention and availability of word-processing software has changed the ways in which many professors and college students write papers. The World Wide Web has changed the way people acquire and search for information. Vygotsky thought the same principle applied to the existence of written language: It significantly transformed intellectual processes.

The Laboratory of Comparative Human Cognition (1983) described Vygotskian principles of how cultures affect cognition and cognitive development. First, cultures "arrange for the occurrence or non-occurrence" (p. 335) of particular problems and problem-solving environments. For example, whether one needs to learn to memorize prayers or pledges depends on whether the culture presents tasks or occasions for which they are recited from memory. If the culture does not require such memorization, then people within that culture have less need to develop strategies for and approaches to this task.

Second, the culture determines the frequency with which problems and practices occur. Does recitation take place daily? Weekly? Monthly? Frequency will no doubt affect how often practice with the tasks occurs.

Third, cultures determine which events go together. Does memorization occur with other tasks, such as reading or measuring? It seems likely that the co-occurrence of two tasks provides a different context for each and may therefore affect the way each is carried out.

■ Photo 14.4: Schooling has been shown in many studies to affect performance on a variety of cognitive tasks.

Last, cultures "regulate the level of difficulty" of tasks within contexts (Laboratory of Comparative Human Cognition, 1983, p. 335). Cultures determine how younger members may approach a memorization task, for example. Cultures also figure out ways of establishing a graded series of tasks that culminate in final mastery. A 4-year-old, for example, may start out learning simple rhymes and gradually work up to long prayers or epic poems. The culture determines the path from first to final achievement.

Recall discussion of the work of Alexander Luria (a student of Vygotsky), who worked with farmers in Uzbekistan, a remote part of the former Soviet Union, during the 1930s (Luria, 1976). During that time, collectivization of farming and industrialization were being introduced, and the region experienced profound socioeconomic changes. As part of this social and economic revolution, some of the residents attended literacy programs. Luria compared, on a variety of perceptual, reasoning, and classification tasks, the performance of people who had and had not participated in a literacy program. He found consistent group differences: Nonliterate people were most likely to respond to tasks in a concrete, perceptual, and context-bound manner; the schooled group showed greater ability or propensity to deal with materials more abstractly and conceptually. The schooled group could reason from premises and draw inferences based on something other than their own experience.

One problem in interpreting Luria's (1976) findings is that two related but conceptually independent factors were confounded: literacy and schooling. As Scribner and Cole (1981) noted, schooling and literacy are often related but are not synonymous. In Luria's research, the participants who were literate were also those who had attended schools; the nonliterate participants were unschooled.

What effects might schooling have on cognition? First of all, it is worth noting the somewhat bizarre demands that school itself places on students. School is one of the few places where one person (the teacher) asks other people (the students) to answer questions that she or he already knows the answer to. Think how incongruous this situation would be in other contexts. Imagine someone walking up to you to ask directions to the library. Being a local resident, you know the way and provide a set of directions, such as "Go two blocks to the light, take a right, then take your first left, go halfway down the block, and you'll see it." Next, your conversation partner tells you your directions are faulty, that there is a simpler way to go. Would you consider this conversation "normal" or "typical"? Only in schoollike situations can a teacher pose questions to assess students' knowledge rather than to obtain information. This somewhat removes the school context from everyday life.

School differs from everyday contexts in a number of other respects. The subjects taught often make little contact with everyday life; students learning about, say, geography or history may never have the chance to experience the phenomena being discussed. Some of the subjects taught are abstract (such as arithmetic and geometry) and make few direct appearances in day-to-day living.

The motivation to complete a task in school—for example, learning a spelling list—is not intrinsic to the task itself in the way that motivation is for an everyday task—for example, learning to ride a bike. In the latter case, you learn because the task itself is important to you; in the former case, students often learn because the teacher or parent tells them to. Bruner (1966) has argued that schooling therefore provides practice in thinking about abstract topics in a decontextualized way—that is, removed from the present context of here and now.

Scribner and Cole (1981) carried out a series of studies to disentangle the effects of literacy from the effects of schooling. They worked with the Vai people in Liberia, West Africa, during the 1970s. The Vai are an interesting people to study because they invented their own writing system, called Vai script, that they use for many commercial and personal transactions. Vai script is taught not in school but in the home. Although only about 7% of the entire population was literate in Vai script at the time of the study, it was the most common written language known by adult males: 20% were literate in Vai script; 16% in Arabic (acquired mostly in the context of learning the Qur'an); and 6% in English, the official language of schools and government.

Interviews were held with 650 people, all aged 15 or older. In addition to completing a lengthy autobiographical questionnaire (regarding demographic information, schooling and literacy status, family schooling and literacy status, occupation, and the like), all respondents participated in an hour-long session in which various cognitive tasks were administered. Included in these were sorting tasks (stimuli used included both geometric figures and familiar objects), memory tasks (such as recalling the names of objects used in the sorting tasks), a logic task (presenting syllogisms, such as those described earlier), and a task of linguistic awareness (such as being asked whether the names of the objects "sun" and "moon" could be switched and what the consequences of such a switch would be). For some tasks, respondents were asked to provide verbal explanations, which were later scored.

The participants were divided into seven groups. The first six included only men 15 and older: nonliterate men; men who were literate in Vai script only; men literate in Arabic only; men literate in both Arabic and Vai; men who had attended some school and were literate in English, Arabic, and Vai; and men who had attended 10 years or more of school. The seventh group consisted of nonliterate women 15 and older (the data from 11 literate Vai women were not reported, presumably because the women were quite atypical in their literacy).

Table 14.3: Results of Scribner and Cole (1981)

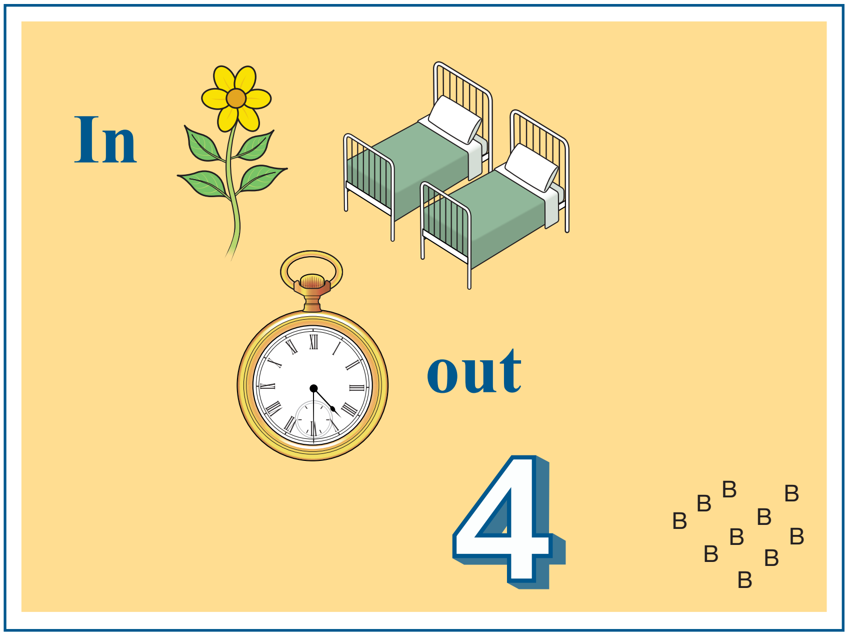
Tasks and Measures	Nonliterate Men	Vai Script Monoliterate	Arabic Monoliterate	Vai Arabic Biliterate	English Schooled	Grade 10+	Nonliterate Women
Geometric sorting (number dimensions sorted out of 3)	1.6	2.0	2.0	1.9	1.7	1.9	1.7
Verbal explanation (max score = 12)	5.3	5.1	5.8	5.6	5.6	9.3	4.9
Classification (max score = 6)	3.4	3.5	3.0	3.5	3.8	3.9	3.4
Verbal explanation (max score = 42)	31.5	31.2	29.0	29.5	32.5	34.6	30.5
Memory (number recalled, max = 24)	16.2	16.0	16.2	16.2	17.1	14.9	16.5
Logic (number correct, max = 6)	1.6	1.3	1.7	1.5	3.0	3.9	1.7
Theoretic explanations (max = 10)	6.1	5.7	6.2	5.7	7.6	7.9	6.2
Language objectivity (max = 3)	.7	.5	.9	1.2	1.3	1.3	.7

The general design called for comparisons of nonliterates, Vai script literates, and schooled groups. The results, some of which are summarized in Table 14.3, were surprising. For most of the cognitive tasks, there were only scattered and small effects of literacy per se. Scribner and Cole (1981) concluded that unschooled literacy (such as acquisition of Vai script literacy in the home) does not produce the general cognitive effects previously reported by Luria (1976) and others.

Schooling, in contrast, did produce a number of effects. The most evident effect was that schooling, especially with English instruction, increased the ability to provide verbal explanations and justifications. The participants who had attended school were much better able to provide coherent explanations of their answers than those who hadn't attended school. The group differences in explanations were sometimes evident even when the schooled and unschooled groups did not differ in performance. In other words, schooling affected not so much which responses were chosen but rather the skill with which respondents could explain and justify their choices.

Scribner and Cole (1981) did discover literacy effects on some specific tasks, however. Most had to do with knowledge of language in one form or another. For example, literate participants were more likely to give good explanations of what makes grammatical sentences in Vai. They also found it easier to learn to "read" other scripts, modeled after children's rebus puzzles (see Figure 14.10 for an example of a rebus puzzle). Scribner and Cole used these principles to invent Vai rebuses and taught these puzzles to both Vai-literate (unschooled) and nonliterate villagers. Literate villagers learned the task much more easily and significantly outperformed the nonliterate villagers.

What can we make of Scribner and Cole's (1981) findings? Contrary to some conventional wisdom, their studies do not support the idea that either literacy or schooling has profound effects on the ways in which cognitive processes operate. Although on some tasks, schooled and/or literate participants outperformed unschooled, nonliterate participants, the latter group often performed just as well, or only slightly worse, than the former groups. However, both literacy and schooling do apparently affect the ways in which some cognitive tasks are carried out, at least in some circumstances. So apparently both schooling and literacy make a difference to cognition, at least sometimes.



■ Figure 14.10: Example of a rebus puzzle. Translation: In flower beds, watch out for bees.

Reviewing all their findings, Scribner and Cole (1981) developed a "practice account of literacy" as a framework for understanding the experimental results. By *practice*, they refer to "a recurrent, goal-directed sequence of activities using a particular technology and particular systems of knowledge" (p. 236). These authors examined the knowledge and skills required for literacy and the knowledge and skills that the practice of literacy enables. What one does to become literate and what one does when one practices his or her literacy (say, by reading or writing a letter) strengthen some very specific skills. Scribner and Cole asserted that literacy does not promote broad, general cognitive changes but rather more localized and task-specific contextualized ones.

The same kind of argument might account for the effects of schooling. Recall that schooled Vai outperformed unschooled Vai only on tasks requiring verbal explanations. Scribner and Cole (1981) pointed to the "practice" of schooling, particularly English schooling, as a potent cause. Schools are places where a premium is placed on the ability to offer an articulate set of reasons for one's responses and to figure out ways to approach and master tasks removed from practical experience (Bruner, 1966). No wonder, then, that those with the most experience in this setting show the most ability to apply the specific skills this setting promotes in other circumstances.

To summarize, Scribner and Cole (1981) argued that cognitive skills are often context bound. From their perspective, it seemed unlikely that many broad cognitive abilities or skills, such as "thinking" or "categorization," exist that one or a few manipulations can affect or improve. Instead, these authors would argue that cognition is situated in, or intimately bound to, the conditions in which it naturally occurs. One's culture and one's everyday surroundings and tasks establish both boundaries and possibilities for the cognitive tasks that are practiced and therefore strengthened. Context and culture affect, and are affected by, cognition.

SITUATED COGNITION IN EVERYDAY SETTINGS

Situated cognition is not simply a phenomenon that occurs in foreign, distant cultures (B. G. Wilson & Myers, 2000). Cultural contexts affect cognition right here at home, as seen in some studies conducted in the workplace. Sylvia Scribner's work before her death included field studies in the United States at an industrial milk-processing plant (a "dairy") in which she investigated on-the-job cognition, or what she called "working intelligence" (Scribner, 1984, p. 9). In particular, she drew a distinction between practical and theoretical thought (Scribner, 1986). The latter is the kind of thinking demanded in many school activities: thinking divorced from a meaningful context, carried out on a task of perhaps limited interest, and performed for its own sake. Practical thought, by contrast, is more familiar and involves thinking "embedded in the larger purposive activities of daily life . . . [that] functions to achieve the goals of those activities" (p. 15). Examples include figuring out a supermarket "best buy" or diagnosing the cause of a machinery malfunction.

The site of Scribner's (1984) field studies employed 300 people in both white- and blue-collar positions. Certain blue-collar tasks were selected for study. These included product assembly (a warehouse job), inventory, and pricing delivery tickets. Scribner and associates began by observing people performing these jobs under normal working conditions, then constructed and presented workers with experimental simulations of these tasks.

From her earlier cross-cultural research, Scribner (1984) believed that cognitive skills are dependent on "socially organized experiences" (p. 10). In other words, the way in which a cognitive task is approached varies according to the environment and the context. She found the same sorts of patterns emerging in the dairy: Even a task as seemingly basic as mental calculation was accomplished in different ways by the same people in different circumstances.

The product assemblers (or preloaders, as they are sometimes called) provide a concrete example. Their job consists mainly of putting together specified quantities of various products and getting them ready to be loaded onto trucks. Scribner (1984) described the working conditions in more detail:

> Product assembly is a warehouse job. It is classified as unskilled manual labor and is one of the lowest paying jobs in the dairy. The perishable nature of dairy products requires that warehouse temperature be maintained at 38 degrees Fahrenheit; accordingly, the warehouse is, and is referred to as, an icebox.
>
> During the day, thousands of cases of milk products (e.g., skim milk, chocolate milk) and fruit drinks are moved on conveyor belts from the plant filling machines into the icebox, where they are stacked in designated areas along with many other dairy products (e.g., yogurt, cottage cheese). Preloaders arrive at the icebox at 6 P.M. Awaiting them is a sheaf of route delivery orders, called load-out order forms. Each form lists the products and their amounts that a wholesale driver has ordered for his next day's delivery. The preloader's task is to locate each product. Using a long metal "hook," he pulls the required number of cases and partial cases of that product and transports them to a common assembly area near a moving track that circles the icebox.
>
> When all the items of a given truck order are assembled, they are pulled onto the track and carried past a checkpoint to the loading platform. (pp. 18–19)

Scribner (1984) noticed an interesting problem that preloaders faced in their jobs. Truck drivers wrote orders that expressed quantities of items in terms of one set of units (for example, quarts of milk, half-pints of chocolate milk), but fluid products in the warehouse were stored in cases, not in units. Cases of all products were the same size but contained a different number of units, depending on the product. So a full case could contain 4 gallon units, 9 half-gallon units, 16 quart units, 32 pint units, or 48 half-pint units.

Load-out forms were created by computer by converting drivers' orders into cases. So a particular driver's request for 4 gallons of fruit juice would be translated into one case. Often a driver's request did not divide evenly into number of cases. For example, if a driver requested 5 gallons of milk, that would translate into one case plus one unit. The load-out forms followed the following convention: If the number of "leftover" units was equal to half a case or less, the order was expressed as the number of cases plus the number of units (as in the 5-gallon example). If the number of "leftover" units was more than half a case, the number was expressed as the number of cases minus the number of units. So in the case of quarts (which come 16 to a case), if a driver ordered 30 quarts of chocolate milk, the load-out form would read 2 (cases = 32 quarts) – 2 (quarts)—that is, 32 – 2 = 30. (Warning: This system is not intuitive, so work through this example carefully yourself.)

Scribner's (1984) question was how preloaders dealt with mixed numbers, such as 3 + 1 or 7 – 5, in assembling orders. You might think such a question would be answered in a fairly obvious way: A preloader with an order for 1 – 6 would simply grab 1 case and remove 6 units from it. But this is not what happened.

In fact, the preloaders handled the very same problem (that is, 1 – 6) in several different ways. Sometimes they filled the order in the "obvious" way just described. Other times, they mentally "rewrote" the order and used nearby partially filled cases to reduce the actual number of units that had to be moved. For example, when a nearby partially filled case of quarts (remember, 16 quarts to the case) contained 14 quarts, the preloader simply removed 4 (1 case – 6 quarts = 10 quarts; 14 quarts – 4 quarts = 10 quarts). In another situation, a partially filled case contained 8 quarts, and the preloader simply added 2 more.

Scribner (1984, 1986) found that although the same problem was solved in different ways, the solution always honored the following rule: Satisfy the order with the least number of moves—that is, the least number of transfers of product units. Even when the "saving" of labor was small (for example, saving one transfer in an order totaling 500 units), experienced preloaders rapidly and almost automatically calculated and followed the most efficient solution. The mental calculations required are impressive because of both their rapidity and accuracy. Errors were rare. And most of the time, the workers were assembling a group of orders at the same time, thus most certainly increasing the cognitive demands of their job.

It also turned out that on-the-job training was necessary to develop this cognitive flexibility. "Novice" preloaders—that is, other workers in the dairy and a comparison group of ninth graders—were much less efficient and skilled, relative to the preloaders, at finding the optimal solution. Scribner (1984) constructed a simulation task with various orders and administered it to other dairy workers and to a group of ninth-grade students. When the optimal solution required some mental transformation of the order, preloaders found it about 72% of the time; inventory people (many of whom had some experience working as a preloader), 65%; clerks at the dairy (with little if any product assembly experience), 47%; and ninth graders, 25%. Students in particular tended to be very "algorithmic" and "literal" in their approaches to problems, solving each problem in the same way and in the way specified on the load-out form even when much easier strategies (that required some mental transformations) were available.

Scribner (1986) found similar examples of cognitive flexibility in other experienced workers working at other jobs. She concluded that although formal problem solving—such as that required in school, on tests, and in many cognitive psychology experiments—requires or encourages set approaches and fixed rules, practical thinking does not. Instead, practical thinking "frequently hinges on an apt formulation or redefinition of the initial problem" (p. 21). Practical problem solving is flexible and requires different approaches to the "same" problem, with each approach tailored to the immediate context. Note the difference between this kind of thinking and "academic" thinking, which typically requires or at least encourages all instances of a problem to be solved in the same way.

Similar findings were reported in another work setting, a grocery store (Lave et al., 1984). Although not generally part of a paying job, grocery shopping is an activity that must be completed frequently to maintain a family. Lave and associates used the grocery store as a setting for studies of cognitive processing in everyday life. These authors studied 25 grocery shoppers. Participants represented a range of socioeconomic statuses and had varying educational backgrounds. Researchers accompanied shoppers throughout shopping trips and recorded conversations they had with shoppers.

Typical supermarkets contain around 7,000 distinct items, and typical shoppers purchase about 50 weekly (Lave et al., 1984). Obviously, then, the number of potential decisions is quite large. How does the typical shopper manage to finish in about 1 hour? Again, the answer has to do with cognitive flexibility and adapting solutions to specific features of the problem.

■ Photo 14.5: Lave and associates (1984) have used the grocery store as a setting for studies of cognitive processing in everyday life.

One shopper, for example, found a package of cheese marked with a price that the shopper considered surprisingly high. To determine whether the price was correct, he found another package of cheese in the bin that weighed approximately the same amount. He then compared the prices on the two packages and indeed found them discrepant. Which one had the error? To find out, he compared these two packages to others in the bin, determining that the first one was, in fact, priced incorrectly. Notice here a "saving" in amount of mental effort: Although he could have calculated the price per ounce of each package, such calculations are mentally demanding and subject to error. Instead, he found an alternative way of solving the problem that was both more easily accomplished and less likely to be inaccurate.

Lave et al. (1984) were specifically interested in the arithmetic people used in grocery stores. The researchers found that people's in-store arithmetic was virtually flawless—accuracy was 98%, compared with an average accuracy of 59% that the same people had on school-like arithmetic tests. Why the discrepancy? In part, people often invented ways of circumventing traditional calculations, as in the example just given. Again, we see that the skills learned in school may be used outside the classroom in much more creative, flexible, and effective ways.

Ceci and Roazzi (1994) described similar findings reported by Carraher and associates with Brazilian children who worked as street vendors. When given problems embedded in real-life situations (for example, "If a large coconut costs 76 cruzeiros, and a small one costs 50, how much do the two cost together?"), children's performance averaged 98% correct. When the same problem was posed as a formal test question ("How much is 76 + 50?"), performance averaged only 37% correct.

Again, the point of much of the work described in this chapter is to show that much of what we take to be "the" way cognition works is really "a" way cognition works in a particular setting. Cognitive processes do not always work the same way, and some cognitive processes we may regard as fundamental (for example, processes involved in perception or memory or thinking) may change radically, even in adults. Nisbett and Norenzayan (2002) remind us that "cultural practices and cognitive processes constitute one another. Cultural practices encourage and sustain certain kinds of cognitive processes, which then perpetuate the cultural practices" (p. 562).

CHAPTER 14

Summary

1. Cross-cultural cognitive research has shown that the ways in which a cognitive task is approached and executed need not be exactly the same for all people at all times. Some tasks, because they are familiar, are easier, at least in the way expected by a cognitive psychologist from mainstream US culture. As Wober (1969) put it, too often the use of cognitive tasks developed in one culture to study the cognition of people from another culture simply measures "How well can they do our tricks?" (p. 488). People from the second culture may perform poorly on the test but still have the cognitive capacities the test was designed to measure.
2. People from different cultures find ways of solving the cognitive (and other) challenges that confront them. A given environment, including a cultural one, strengthens certain skills, strategies, and approaches at the expense of others. This in turn makes certain tasks easier and seemingly more "natural" and others harder.
3. As noted earlier, cognition is often quite flexible. Practice with any task typically speeds execution and enables greater accuracy. This point raises another, however: Practice often affects the way a task is done. This suggests that researchers need to assess not only the familiarity of a task to a person from a given culture but also the person's specific level of practice with that (or a similar) task.
4. Formal schooling changes some, although certainly not all, important aspects of cognitive processing. In particular, schooling affects one's ability to deal with more "abstract" materials; to rely less heavily on contextual, immediate cues from the surrounding environment; and to explain one's responses and thinking more clearly. Schooling also helps people figure out how to approach novel tasks, especially in planning and structuring. All in all, schooling apparently helps people "step back" from their everyday routine and promotes their thinking from different points of view. And, as the Laboratory of Comparative Human Cognition (1983) pointed out, school prepares people especially well to participate in cognitive psychology experiments!
5. Interestingly, basic academic skills turn out not to be entirely optimal for meeting everyday cognitive challenges. Practice with a specific task, whether grocery shopping or conducting inventory, apparently leads to the invention of clever shortcuts that reduce the effort (mental or physical) required and increase accuracy. Although schools may insist that students approach all calculation problems in similar ways, research is beginning to suggest that in the "real world," the approaches taken to a problem vary with the immediate context.
6. A general and important point is that models of a cognitive process often presume, implicitly, that the task in question is universally important and familiar, an assumption that researchers have recently questioned. Similarly, existing cognitive models often assume that the same cognitive procedures are used the same way for all versions of a problem, although new research challenges this belief. Dropping these assumptions will no doubt make the job of cognitive researchers much more difficult. In the long run, however, the new models will be more accurate and more complete.

Review Questions

1. What does it mean to assert that a particular cognitive capacity or skill is culturally relative or culturally universal? How do the assertions differ?
2. Describe Hudson's studies of pictorial perception and discuss their implications.
3. Kearins concluded that culture can impose "environmental pressure" on certain cognitive skills. Discuss this conclusion with respect to the empirical findings of Kearins or of others.
4. Schooling appears to help cognitive performance, especially on tasks such as formal reasoning. Explain why this might be so.
5. Schooling and literacy are distinct factors that appear to affect cognitive performance differently. Describe one or two of the differences and speculate on reasons for the difference(s).
6. How are Scribner's studies of dairy workers consistent with, and inconsistent with, cross-cultural studies of cognition?

Key Terms

cultural relativism

cultural universality

culture

literacy

schooling

situated cognition

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