Cultural Differences in Thinking

WE WERE by no means the first to realize that comparisons of intellectual activity in different cultures could yield important information about the origin and organizations of man's intellectual functioning. For many decades before I met Vygotsky there had been widespread debate on the question of whether people growing up under different cultural circumstances would differ in the basic intellectual capacities they developed as adults. As early as the beginning of the century Durkheim assumed that the basic processes of mind are not manifestations of the spirit's inner life or the result of natural evolution; mind originates in society. Durkheim's ideas formed the basis of a number of studies and discussions. Prominent among those who furthered the debate was the French psychologist Pierre Janet. Janet proposed that complex forms of memory, as well as complex ideas of space, time, and number, had their sources in the concrete history of a society and were not intrinsic categories of mind as classical, idealist psychology believed them to be.

In the 1920s this debate centered on two questions: whether the contents of thought, the basic categories used to describe experience, differ from culture to culture; and whether the basic intellectual operations people perform on information differ from one culture to another. Lucien Levy-Bruhl, who influenced many psychologists of the period, argued that the thought of primitive, nonliterate people employs a different set of rules and operations from those employed in the thought of modern people. He characterized primitive thinking as "prelogical" and "loosely organized." Primitive people were said to be indifferent to logical contradiction and dominated by the idea that mystical forces control natural phenomena.

His opponents, such as the English ethnographer-psychologist W. H. R. Rivers, proposed that the intellect of people in primitive cultures is fundamentally identical to that of contemporary people living in technological societies. Rivers suggested that people living in primitive conditions think in accordance with the same logical laws we do. The basic difference in thinking is that they generalize the facts of the external world into different categories from those we are accustomed to use.

Various Gestalt psychologists also applied their ideas to the question of "primitive" thinking. Heinz Werner emphasized the differences in thought that distinguish the modern adult from the primitive. He speculated on the "structural similarity" of thinking among primitive people, children, and deranged adults. He saw undifferentiated, "syncretic" thinking as the characteristic feature of cognitive activity in all these groups. Other Gestalt psychologists emphasized the common properties of mind in all cultures. They promoted the idea that principles of perception and thought such as "closure" or "good form" are universal categories of mind.

These and other proposals were understandably of great interest to us. But the discussion was being conducted without the benefit of any appropriate psychological data. The data relied upon by Levy-Bruhl as well as by his anthropological and sociological critics—in fact, the only data available to anyone at that time—were anecdotes collected by explorers and missionaries who had come in contact with exotic people in the course of their travels. Professional anthropological field work was still in its infancy, so appropriate data of the observational sort were virtually nonexistent. Only a few studies on sensory processes, carried out by trained psychologists at the turn of the century, were available. These did not address the issues under debate, which concerned higher, not elementary, cognitive functions.

Things were no better in the area of psychological theory. The long-standing division of psychology into its natural (explanatory) and phenomenological (descriptive) branches had robbed psychologists of a unifying framework within which to study the effects of culture on the development of thought. Vygotsky's theory provided us with the needed framework, but we lacked the data to which we could apply our ideas.

We conceived the idea of carrying out the first far-reaching study of intellectual functions among adults from a nontechnological, nonliterate, traditional society. Moreover, by taking advantage of the rapid cultural changes that were then in progress in remote parts of our country, we hoped to trace the changes in thought processes that are brought about by social technological change. The early 1930s were especially suitable for carrying out the necessary experiments. At that time many of our rural areas were undergoing rapid change with the advent of collectivization and mechanization of agriculture. Although we could have conducted our studies in remote Russian villages, we chose as our research sites the hamlets and nomad camps of Uzbekistan and Khirgizia in Central Asia where great discrepancies between cultural forms promised to maximize the possibility of detecting shifts in the basic forms, as well as in the content of people's thinking. With Vygotsky's help I planned a scientific expedition to these areas.

Uzbekistan could boast of an ancient high culture which included the outstanding scientific and poetic achievements associated with such figures as Uleg Bek, a mathematician and astronomer who left behind a remarkable observatory near Samarkand, the philosopher Al-Biruni, the physician Ali-ibn-Senna (Avecenna), the poets Saadi and Nezami, and others. However, as is typical of feudal societies, the peasant masses remained illiterate and for the most part separated from this high culture. They lived in villages that were completely dependent on wealthy landowners and powerful feudal lords. Their economy was based mainly on the raising of cotton. Animal husbandry prevailed in the mountainous regions of Khirgizia adja-

cent to Uzbekistan. The conservative teachings of the Islamic religion were profoundly influential among the population and acted to keep women isolated from the life of society.

Following the Revolution these areas underwent profound socioeconomic and cultural changes. The old class structure was dissolved, schools were set up in many villages, and new forms of technological, social, and economic activities were introduced. The period we observed included the beginnings of collectivization of agriculture and other radical socioeconomic changes, as well as the emancipation of women. Because the period was one of transition, we were able to make our study comparative to some extent. Thus we could observe both underdeveloped nonliterate groups living in villages and groups already involved in modern life who were experiencing the influences of the social realignment that was occurring.

None of the populations we observed had received any higher education. Even so, they differed markedly in their practical activities, modes of communication, and cultural outlooks. Our subjects came from five groups:

1. Women living in remote villages who were illiterate and who were not involved in any modern social activities. There were still a considerable number of such women at the time our study was made. Their interviews were conducted by women, since they alone had the right to enter the women's quarters.
2. Peasants living in remote villages who were in no way involved with socialized labor and who continued to maintain an individualistic economy. These peasants were not literate.
3. Women who attended short-term courses in the teaching of kindergarteners. As a rule, they had no formal schooling and almost no training in literacy.
4. Active kolhoz (collective farm) workers and young people who had taken short courses. They were involved as chairmen running collective farms, as holders of other offices on the collective farm, or as brigade leaders. They had considerable experience in planning production, distributing labor, and taking

stock of output. By dealing with other collective farm members, they had acquired a much broader outlook than isolated peasants. But they had attended school only briefly, and many were still barely literate.

5. Women students admitted to teachers school after two or three years of study. Their educational qualifications, however, were still fairly low.

We assumed that only the final three groups, who by participating in the socialist economy had gained access to the new forms of social relations and the new life principles accompanying the changes, had experienced the conditions necessary to alter radically the content and form of their thought. These social changes had brought them into contact with technological culture and with literacy and other forms of knowledge. The first two groups had been exposed to a much lesser extent to the conditions that we assumed necessary for any fundamental psychological shift. Accordingly, we expected that they would display a predominance of those forms of thought that come from activity that is guided by the physical features of familiar objects. We also expected to find that the communication requirements of people doing planned, collectivized farming would have an impact on their thinking. Furthermore, we assumed that we could observe the changes caused by cultural and socioeconomic realignment through a comparison of the mental processes of these groups.

Adequate research methods had to include more than simple observation, and our methods approached a full-fledged experimental inquiry. But such a study inevitably encountered a number of difficulties. Short-term psychological experiments would have been highly problematic under the field conditions we expected to encounter. We were afraid that if, as strangers, we posed unusual problems that were unrelated to our subjects' habitual activities, they might become perplexed or suspicious. Administering isolated "tests" in such circumstances could yield data that misrepresented the subjects' actual capabilities. Therefore we began, as most field work with people does, by emphasizing contact with the people who would serve as our subjects. We tried to establish friendly relations so that experimental sessions seemed natural and nonthreatening. We were particularly careful not to conduct hasty or unprepared presentations of the test materials.

As a rule, our experimental sessions began with long conversations which were sometimes repeated with the subjects in the relaxed atmosphere of a tea house, where the villagers spent most of their free time, or in camps in the field and in mountain pastures around the evening campfire. These talks were frequently held in groups. Even when the interviews were held with one person, the experimenter and other subjects made up a group of two or three who listened attentively to the person being interviewed and who sometimes offered remarks or comments on what he said. The talk often took the form of a free-flowing exchange of opinion between participants, and a particular problem might be solved simultaneously by two or three subjects, each proposing an answer. Only gradually did the experimenters introduce the prepared tasks, which resembled the "riddles" familiar to the population and therefore seemed like a natural extension of the conversation.

Once a subject proposed a solution to a problem, the experimenter conducted a "clinical" conversation to determine how the subject had arrived at the solution and to gain more information about what he meant by it. A subject's response usually led to further questions and to some debate. To reduce confusion in the free discussion that followed, which was conducted in Uzbek, the experimenter left the actual recording of the results to an assistant, who usually sat near the discussion group and took care to avoid attracting attention. He made notes throughout the session. Only later did he prepare a clean copy and process the data. Although this laborious procedure required half a day for a brief session, it was the only practice adequate to the field conditions.

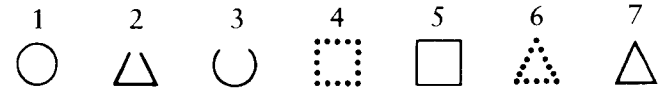
We also tried to make the content of the tasks presented to the

subjects as natural as possible. It would have been foolish to give our subjects problems they regarded as pointless. Thus we used no standard psychometric tests. Instead we worked with specially developed tests that the subjects found meaningful and which were open to several solutions, each of which indicated some aspect of cognitive activity. For example, we contrived our categorization studies so that they could be solved either in a functional-graphic way, based, for example, on how things look or work, or in an abstract, categorical way. A subject could solve deductive reasoning problems either by using what he knew about the world or by using the terms of the information given in the problems to go beyond his experience and deduce the answer.

We also introduced some learning tasks into our sessions. By offering to help subjects in certain ways, we tried to show them how and to what extent they could use our assistance in solving a given problem and go on to solving others like it by themselves. This procedure allowed us to explore how people incorporate new ways of problem solving into their repertoire of intellectual activities.

Our basic hypothesis was tested using techniques that assessed the way people cognitively reflect their experience at several levels of analysis. We began with the way people linguistically code such basic categories of their visual experience as color and shape. Next we studied classification and abstraction. And finally we turned our attention to such complex cognitive activities as verbal problem solving and self-analysis. In each of these areas we discovered a shift in the organization of people's cognitive activity that paralleled the changes in the social organization of their work lives.

A basic change in perceptual categories that recurred in all of our observations was encountered in the way that subjects from our different groups named and grouped geometric stimuli such as those shown in the accompanying figure, which are numbered for ease of identification:



A typical list of names given by nonliterate women living in remote villages was as follows:

1. a plate
2. a tent
3. a bracelet
4. beads
5. a mirror
6. a clock
7. a kettle stand

As subjects had more experience with literacy classes or organized collective farming techniques, abstract geometric names became predominant, and women at a teachers training school used such names exclusively.

This difference in naming was accompanied by a distinct difference in the figures that were classified as the same or similar. For the more traditional peasants, concrete likeness was the dominant mode of grouping. So, △ and ⏢ were considered to be alike because "they are both window frames"; ⧋ ⬚ were both watches, but ◡ ● □ were not alike in any way.

We were particularly interested in our subjects' rejection of our suggestions that such pairs as ● and ◡ were alike. These figures closely resemble the kind of stimuli that our Gestalt colleagues had used to demonstrate what they considered to be universal laws of perception. In their experiments, which as a rule had used well-educated subjects, they found that such figures were normally grouped together because they were both "representatives" of the abstract class of circles. Their subjects ignored the "individual" feature of each of the figures, isolated the major feature of "geometrical class," and made a decision on this basis. But when we asked traditional peasants whether these figures were alike, they answered no. They perceived the figures as similar to objects in their environment and classified them accordingly. "No, they cannot be alike," one peasant said, "because the first is a coin and the second a moon." To be sure, slightly educated subjects classified these stimuli on the basis of

their general configuration, but we could no longer attribute this mode of classification to any "universal law of perception." This kind of categorical perception reflects historically developed and transmitted ways of classifying objects in the world around us. More educated subjects may classify such stimuli on the basis of a single "ideal" property, but this is not a natural and inevitable achievement of the human mind.

Man can perceive three million different hues, but there are only sixteen to twenty names for colors. Does this mean that the perception and classification of hues vary with the names of different colors themselves? Or do language and practical attitudes toward different colors evoke any changes in how people perceive and classify them? We studied the perception and classification of colors of various groups in our subject population and obtained results that were analogous to those in our studies of the perception of geometric figures.

We asked subjects in our basic groups to name and classify colored skeins of wool. Uneducated subjects, especially the women, many of whom were excellent weavers, used very few categorical color names. Instead they labeled the colored pieces of wool by the names of similarly colored objects in their environment. For example, they called various hues of green by the names of different plants: "the color of grass in the spring," "the color of mulberry leaves in the summer," "the color of young peas." When these subjects were asked to group together different strings that were similarily colored, many refused outright, claiming that each string was distinct. Others ordered them into a continuous series of colors which increased in hue or saturation. This pattern of responding to the individual skeins of wool on a visually dominated, particularistic basis disappeared in our other experimental groups, whose responses were dominated by the categorical color names and who readily classified similar colors together.

Our next series of studies concerned the way in which people categorize and make generalizations about objects in their everyday world. Unlike a set of different-colored strands of

wool or two-dimensional geometric figures, the objects in our daily life are rarely categorized on the basis of some common physical attribute. Rather, they can be categorized in a variety of ways, and it was the nature of this variety in which we were interested.

On the basis of his developmental research Vygotsky made a number of distinctions between the types of categories that children were found to use at different ages. During the early stages of a child's development, words are not an organizing factor in the way that he categorizes his experience. Having no logical principle for grouping objects, the small child perceives each object in isolation. During the next stage of categorization the child begins to compare objects on the basis of a single physical attribute, such as color, form, or size. But in making these comparisons, the child quickly loses sight of the attribute he originally singled out as the basis for selecting objects and shifts to another attribute. As a result, he often assembles a group or chain of objects that reflects no unified concept. The logical structure of such groupings in fact often suggests a family in which one individual is included as the "son" of a central figure, a second as the "wife," and so on. This type of group structure can be detected when objects are incorporated into a general situation in which each participates on an individual basis. An example of such a grouping would be a "meal" in which the chair is used to sit on at the table, a cloth is used to cover the table, a knife to cut the bread, a plate to put the bread on, and so on.

This way of grouping objects is not based on a word that allows one to single out a common attribute and denote a category that logically subsumes all the objects. Rather, the determining factor in classifying objects into situational complexes of this sort is called functional-graphic perception or remembering of the real life relations among objects. Vygotsky found that grouping objects according to their relations in actual situations is typical of older preschoolers and elementary school children.

By the time children reach adolescence, they no longer generalize on the basis of their immediate impressions. Instead they

categorize by isolating certain distinct attributes of objects. Each object is assigned to a specific category by relating it to an abstract concept. After establishing a system for including diverse objects in a single category, adolescents develop a hierarchical conceptual scheme that expresses increasingly greater "degrees of community." For example, a rose is a flower, a flower is a plant, a plant is a part of the organic world. Once a person has made the transition to this mode of thought, he focuses primarily on the "categorical" relations between objects, not on the concrete way in which they interact in real situations.

It is easy to understand that the psychological laws governing such taxonomic thinking differ entirely from the process at work when a person is making generalizations on the basis of concrete experience. Categorical thinking is not just a reflection of individual experience but a shared experience that society can convey through its linguistic system. This reliance on society-wide criteria transforms functional-graphic thinking processes to a scheme of semantic and logical operations in which words become the principal tool for abstraction and generalization.

Since all activity is initially rooted in graphic, practical operations, we believed that the development of taxonomic, conceptual thinking would hinge on the theoretical operations which a child learns to perform in school. If the development of taxonomic thinking did depend on formal schooling, then we would expect to see taxonomic forms of abstraction and generalization only in those adult subjects who had been exposed to some kind of formal schooling. Because most of the subjects in our studies had attended little or no school, we were curious about the principles that they would apply to grouping objects encountered in their everyday life.

Almost all the subjects listened to the instructions attentively and set to work eagerly. Yet often, even at the beginning, instead of trying to select similar objects, they proceeded to choose objects that were "suitable to a specific purpose." In other words, they rejected the theoretical task and replaced it with a practical one. This tendency became apparent early in

our experimental work when subjects began to evaluate objects in isolation and to name their individual functions. For example, "this one" was needed to do such and such a job, and "that one" for a different job. They saw no need to compare and group all the objects and to assign them to specific categories. Later in the experimental sessions, as a result of our discussion and of the various probe questions asked, many of the subjects overcame this tendency. Even then, however, they tended to deal with the task as a practical one of grouping objects according to their role in a particular situation rather than as a theoretical operation of categorizing them according to a common attribute. As a result, each subject grouped the objects in an idiosyncratic way depending on the particular graphic situation he had in mind. The concrete groups that our subjects created on the basis of this "situational" thinking were extremely resistant to change. When we tried to suggest another way to group the objects based on abstract principles, they generally rejected it, insisting that such an arrangement did not reflect the intrinsic relations among the objects and that a person who had adopted such a grouping was "stupid." Only in rare instances did they concede the possibility of employing such a means of classification, and even then they did so reluctantly, convinced that it was not important. Only classification based on practical experience struck them as proper or important.

The following example illustrates the kind of reasoning we encountered. Rakmat, a thirty-year-old illiterate peasant from an outlying district, was shown drawings of a hammer, a saw, a log, and a hatchet. "They're all alike," he said. "I think all of them have to be here. See, if you're going to saw, you need a saw, and if you have to split something, you need a hatchet. So they're all needed here."

We tried to explain the task by saying, "Look, here you have three adults and one child. Now clearly the child doesn't belong in this group."

Rakmat replied, "Oh, but the boy must stay with the others! All three of them are working, you see, and if they have to keep

running out to fetch things, they'll never get the job done, but the boy can do the running for them . . . The boy will learn; that'll be better, then they'll all be able to work well together."

"Look," we said, "here you have three wheels and a pair of pliers. Surely, the pliers and the wheels aren't alike in any way, are they?"

"No, they all fit together. I know the pliers don't look like the wheels, but you'll need them if you have to tighten something in the wheels."

"But you can use one word for the wheels that you can't for the pliers—isn't that so?"

"Yes, I know that, but you've got to have the pliers. You can lift iron with them and it's heavy, you know."

"Still, isn't it true that you can't use the same word for both the wheels and the pliers?"

"Of course you can't."

We returned to the original group, including hammer, saw, log, and hatchet. "Which of these could you call by one word?"

"How's that? If you call all three of them a 'hammer,' that won't be right either."

"But one fellow picked three things—the hammer, saw, and hatchet—and said they were alike."

"A saw, a hammer, and a hatchet all have to work together. But the log has to be here too!"

"Why do you think he picked these three things and not the log?"

"Probably he's got a lot of firewood, but if we'll be left without firewood, we won't be able to do anything."

"True, but a hammer, a saw, and a hatchet are all tools?"

"Yes, but even if we have tools, we still need wood. Otherwise, we can't build anything."

The subject was then shown drawings of a bird, rifle, dagger, and bullet. He remarked, "The swallow doesn't fit here . . . . no, this is a rifle. It's loaded with a bullet and kills the swallow. Then you have to cut the bird up with the dagger, since there's

no other way to do it. What I said about the swallow before is wrong! All these things go together!"

"But these are weapons. What about the swallow?"

"No, it's not a weapon."

"So that means these three go together and the swallow doesn't?"

"No, the bird has to be there too. Otherwise, there'll be nothing to shoot."

He was then shown drawings of a glass, saucepan, spectacles, and a bottle. He observed, "These three go together, but why you've put the spectacles here, I don't know. Then again, they also fit in. If a person doesn't see too good, he has to put them on to eat dinner."

"But one fellow told me one of these things didn't belong in this group."

"Probably that kind of thinking runs in his blood. But I say they all belong here. You can't cook in the glass, you have to fill it. For cooking, you need a saucepan, and to see better, you need the spectacles. We need all four of these things, that's why they were put here."

This tendency to rely on operations used in practical life was the controlling factor among uneducated and illiterate subjects. Subjects whose activities were still dominated by practical labor, but who had taken some school courses or had attended training programs for a short time, were inclined to mix practical and theoretical modes of generalization. The somewhat more educated group of subjects employed categorical classification as their method of grouping objects even though they had had only a year or two of schooling. For example, when we asked them which of the following three objects go together—a glass, saucepan, spectacles, and a bottle—they immediately responded, "The glass, the spectacles, and the bottle go together. They are made of glass, but the saucepan is metal." Similarly, when given the series of camel, sheep, horse, and wagon, they responded, "The wagon doesn't belong. All the others are animals." I could

give more examples, but they are all the same: the individual picked out single attributes to make his generalization (such as "glass") and used a category name to subsume the different objects (such as "animals").

A somewhat different way of characterizing these results is to say that the primary function of language changes as one's educational experience increases. When people employ a concrete situation as a means of grouping objects, they seem to be using language only to help them recall and put together the components of the practical situation rather than to allow them to formulate abstractions or generalizations about categorical relations. This raised the question of whether abstract terms in their language, such as "tool," "vessel," or "animal," actually had more concrete meaning for them than for better educated subjects. The answer turned out to be yes.

For example, we presented three subjects (1–3) with drawings of an ax, a saw, and a hammer and asked, "Would you say these things are tools?"

All three subjects answered yes.

"What about a log?"

1: "It also belongs with these. We make all sorts of things out of logs—handles, doors, and the handles of tools."

2: "We say a log is a tool because it works with tools to make things. The pieces of logs go into making tools."

"But" we remarked, "one man said a log isn't a tool since it can't saw or chop."

3: "Some crazy fellow must have told you that! After all, you need a log for tools, together with iron it can cut."

"But I can't call wood a tool?"

3: "Yes, you can—you can make handles out of it."

"But can you really say wood is a tool?"

2: "It is! Poles are made out of it, handles. We call all the things we have need of 'tools.'"

"Name all the tools you can."

3: "An ax, a mosque [light carriage on springs], and also the tree we tether a horse to if there's no pole around. Look, if we

didn't have this board here, we wouldn't be able to keep the water in this irrigation ditch. So that's also a tool, and so is the wood that goes to make a blackboard."

"Name all the tools used to produce things."

1: "We have a saying: take a look in the fields and you'll see tools."

3: "Hatchet, ax, saw, yoke, harness, and the thong used in a saddle."

"Can you really call wood a tool?"

2: "Yes, of course! If we have no wood to use with an ax, we can't plow and we can't build a carriage."

The answers of these subjects were typical of the group of illiterates with whom we worked, and they indicate that in attempting to define the abstract, categorical meaning of a word, subjects began by including things that in fact belonged to the designated category. But they soon exceeded the limits of the category and added objects that were simply encountered together with items that were members of the designated class, or objects that could be considered useful in an imagined situation in which such items were used. Words for these people had an entirely different function from the function they have for educated people. They were used not to codify objects into conceptual schemes but to establish the practical interrelations among things.

When our subjects had acquired some education and had participated in collective discussions of vital social issues, they readily made the transition to abstract thinking. New experiences and new ideas change the way people use language so that words become the principal agent of abstraction and generalization. Once people are educated, they make increasingly greater use of categorization to express ideas about reality.

This work on word definition, when added to work on classification, led us to the conclusion that the modes of generalization which are typical of the thinking of people who live in a society where rudimentary practical functions dominate their activities differ from the generalization modes of formally edu-

cated individuals. The processes of abstraction and generalization are not invariant at all stages of socioeconomic and cultural development. Rather, such processes are themselves products of the cultural environment.

On the basis of the results showing a shift in how people categorized the objects encountered in their daily lives, we speculated that when people acquired the verbal and logical codes that allowed them to abstract the essential features of objects and assign them to categories, they would also be able to do more complex logical thinking. If people group objects and define words on the basis of practical experiences, one might expect that the conclusions they draw from a given premise in a logical problem would also depend on their immediate practical experience. This would make it difficult, if not impossible, for them to acquire new knowledge in a discursive and verbal-logical fashion. Such a shift would represent the transition from sensory to rational consciousness, a phenomenon that the classics of Marxism regard as one of the most important in human history.

The presence of general theoretical concepts to which more practical ones are subordinated creates a logical system of codes. As theoretical thought develops, the system becomes more and more complicated. In addition to words, which take on a complex conceptual structure, and sentences, whose logical and grammatical structure permits them to function as the basis of judgment, this system also includes more complex verbal and logical "devices" that make it possible to perform the operations of deduction and inference without reliance on direct experience.

One specific device that arises in the course of cultural development is syllogistic reasoning, in which a set of individual judgments give rise to objectively necessary conclusions. Two sentences, the first of which makes the general proposition and the second of which gives a specific proposition, comprise the major and minor premises of the syllogism. When educated adults hear the two premises of a syllogism together, they do not

perceive them as two isolated phrases in juxtaposition. Rather, they "hear" the premises as a logical relation implying a conclusion. For example, I may say:

"Precious metals do not rust.

Gold is a precious metal."

the conclusion "Gold does not rust" seems so obvious that many psychologists were inclined to regard the drawing of such a logical conclusion as a basic property of human consciousness. The phenomenologists or adherents of the Wurzburg school, for instance, spoke about "logical feelings" and implied that such feelings existed throughout the history of mankind. Piaget raised doubts about the ubiquitousness of such "logical feelings" in his studies of the development of intellectual operations. But at the time we did our studies no one had bothered to determine whether or not such logical schemas are invariant at different stages of social history and social development. We therefore set out to study the responses of our subjects to syllogistic reasoning problems.

To determine whether people's judgments were being made on the basis of the logic of the major and minor premises or whether they were drawing conclusions from their own practical experience, we created two types of syllogism. First, we included syllogisms whose content was taken from the immediate practical experience of the people. Second, we created syllogisms whose content was divorced from such experience so that conclusions could be drawn only on the basis of logical deduction.

We were afraid that if the subjects did not perceive the major and minor premises as parts of a single problem, they might forget or distort either element of the problem, in which case their conclusion would be based on evidence other than that which we had presented. To guard against this possibility, we developed a procedure in which we first presented the major and minor premises and then asked subjects to repeat the entire syllogism. We paid particular attention to distortions in the premises and to any questions of the subjects. These distortions

would be important evidence of the extent to which syllogisms were perceived as a unified system. After a subject was able to repeat a syllogism correctly, we went on to see whether he could draw the proper deduction.

One of the first things we found was that the nonliterate subjects often failed to perceive the logical relation among the parts of the syllogism. For them, each of the three separate phrases constituted an isolated judgment. This was manifested when subjects attempted to repeat the separate sentences of the problem, because they recalled them as if they were unrelated and separate, frequently simplifying them and modifying their form. In many cases the sentences virtually lost all syllogistic character.

This can be demonstrated with examples from subjects who were presented the syllogism:

"Precious metals do not rust.
Gold is a precious metal.
Does it rust or not?"

The recall of three subjects (1–3) was as follows:

1: "Do precious metals rust or not?
Does gold rust or not?"

2: "Precious metals rust.
Precious gold rusts.
Does precious gold rust or not?
Do precious metals rust or not?
Does precious gold rust or not?"

3: "These are all precious.
Gold is also precious.
Does it rust or not?"

These examples show that the syllogisms were not perceived by the subjects as a unified logical system. The different parts of the syllogism were remembered as isolated, logically unrelated phrases. Some subjects grasped the interrogative form of the last sentence, which they then transferred to the formulation of both premises. In other instances, the question formulated in the syllogism was repeated regardless of the preceding premise. Thus,

the question was perceived as unrelated to the two interconnected premises.

These results made us realize that further study of logical operations required us to do preliminary work on syllogisms with our subjects in order to stress the universal nature of the premises and their logical interrelations so that subjects would focus their attention on these relations and better recall the basic problem when it came time to make a deduction. In this later work, we contrasted reasoning from syllogisms with familiar and unfamiliar content. When the syllogisms were drawn from the subject's practical experience, our only transformation was to change the particular conditions to which they applied. For example, a syllogism of this type would be:

"Cotton grows well where it is hot and dry.
England is cold and damp.
Can cotton grow there or not?"

The second type of syllogism included material unfamiliar to the subjects so that their inferences had to be purely theoretical. For 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?"

Subjects living under the most backward conditions often refused to make any inferences even from the first kind of syllogism. In such cases, they were likely to declare that they had never been in such an unfamiliar place and did not know whether cotton grew there or not. Only after extended discussion, when they were requested to answer on the basis of what the words suggest, would they reluctantly agree to draw a conclusion: "From your words, it should be that cotton can't grow there, if it's cold and damp. When it's cold and damp, cotton doesn't grow well."

Such subjects refused almost entirely to draw inferences from the second type of syllogism. As a rule, many refused to accept the major premise, declaring, "I've never been in the north and never seen bears." One of our subjects told us, "If you want an

answer to that question, you should ask people who have been there and have seen them." Frequently they would ignore the premise that we gave and replaced it with their own knowledge, saying such things as, "There are different kinds of bears. If one is born red, he'll stay that way." In short, in each case they would avoid solving the task.

These reactions were demonstrated in our discussion with a 37-year-old villager. We posed the syllogism: "Cotton can grow only where it is hot and dry. In England it is cold and damp. Can cotton grow there?"

"I don't know."

"Think about it."

"I've only been in the Kashgar country. I don't know beyond that."

"But on the basis of what I said to you, can cotton grow there?"

"If the land is good, cotton will grow there, but if it is damp and poor, it won't grow. If it's like the Kashgar country, it will grow there too. If the soil is loose, it can grow there too, of course."

The syllogism was then repeated. "What can you conclude from my words?"

"If it's cold there, it won't grow. If the soil is loose and good, it will."

"But what do my words suggest?"

"Well, we Moslems, we Kashgars, we're ignorant people; we've never been anywhere, so we don't know if it's hot or cold there."

Another syllogism was presented: "In the far north, where there is snow, all bears are white. Novaya Zemlya is in the far north, and there is always snow there. What color are the bears there?"

"There are different sorts of bears."

The syllogism was repeated.

"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."

"But what kind of bears are there in Novaya Zemlya?"

"We always speak only of what we see; we don't talk about what we haven't seen."

"But what do my words imply?" The syllogism was again repeated.

"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."

"But on the basis of my words, 'in the north, where there is always snow, the bears are white,' can you gather what kind of bears there are in Novaya Zemlya?"

"If a man was sixty or eighty and had seen a white bear and had told about it, he could be believed, but I've never seen one and hence I can't say. That's my last word. Those who saw can tell, and those who didn't see can't say anything!"

At this point a young Uzbek volunteered, "From your words it means that bears there are white."

"Well, which of you is right?"

The first subject replied, "What the cock knows how to do, he does. What I know, I say, and nothing beyond that!"

The results from many interviews of this kind seem particularly clear: the process of reasoning and deduction associated with immediate practical experience dominates the responses of our nonliterate subjects. These people made excellent judgments about facts of direct concern to them, and they could draw all the implied conclusions according to the rules of logic revealing much wordly intelligence. However, as soon as they had to change to a system of theoretical thinking, three factors substantially limited their capability. The first was a mistrust of initial premises that did not arise out of their personal experience. This made it impossible for them to use such premises as a point of departure. Second, they failed to accept such premises as universal. Rather, they treated them as a particular statement reflecting a particular phenomenon. Third, as a result of these two factors, the syllogisms disintegrated into three isolated, particular propositions with no unified logic, and they had no way in

which to channel thought into the system. In the absence of such a logical structure, the subjects had to answer the problems by guessing or by referring to their own experience. Although our nonliterate peasant groups could use logical relations objectively if they could rely on their own experience, we can conclude that they had not acquired the syllogism as a device for making logical inferences.

As in all of our other research, the picture changed sharply when we turned our attention to the educated subjects, who responded to these logical syllogisms much as we would. They immediately drew the correct, and to us obvious, conclusion from each of the syllogisms presented, regardless of the factual correctness of the premises or their application to a subject's immediate experience.

I have briefly described only three kinds of experiments from a much larger set that we conducted in the course of our two expeditions. These were followed by careful analyses of problem solving and reasoning, imagination and fantasy, and the ways in which informants evaluated their own personalities. We dubbed these later observations "anti-Cartesian experiments" because we found critical self-awareness to be the final product of socially determined psychological development, rather than its primary-starting point, as Descartes' ideas would have led us to believe. I will not repeat all the details of these experiments because the pattern remained constant across experiments. In all cases we found that changes in the practical forms of activity, and especially the reorganization of activity based on formal schooling, produced qualitative changes in the thought processes of the individuals studied. Moreover, we were able to establish that basic changes in the organization of thinking can occur in a relatively short time when there are sufficiently sharp changes in social-historical circumstances, such as those that occurred following the 1917 Revolution.

Mental Development in Twins

THE IDEA of studying identical and fraternal twins in order to separate the contributions of heredity and environment to a particular human characteristic was by no means original with us. At the time we undertook this work in the early 1930s, we were familiar with the work of K. J. Holzinger, Cyril Burt, and others who had begun to exploit the possibilities for exploring the origins of human intellectual functions that were inherent in the existence of identical and fraternal twins.

The logic of this approach is by now sufficiently familiar that a sketchy review is all that is needed to show the foundations on which we built. The simplest comparisons involve identical and fraternal twins raised at home. Here one can assume that the social environment for each member of a twin pair is more or less homogeneous, although among pairs there may be a great deal of environmental homogeneity as well, depending on the particular life circumstances of the families, such as educated versus non-educated parents, urban versus rural settings. However, the biological similarity between two twins in the same family will differ according to whether they are monozygotic (identical) or heterozygotic (fraternal). With constant environmental influences, one can assume essentially identical intellectual abilities for identical twins since both environmental and biological causes are more or less identical. For fraternal twins one can assume greater variability owing to differences in genetic makeup. More complex comparisons involving twins sepa-

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