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Culture and Universals: Integrating Social and Cognitive Development

Patricia M. Greenfield
University of California, Los Angeles

In this chapter, I use a small-scale, homogenous society to introduce a large theory of development. After introducing the theory, I then proceed to show the broad applicability of the theory by applying it to our own large-scale, heterogeneous society. The theory links culture and biological maturation to explain development. Although encompassing a critique of the great developmental theories of Piaget and Vygotsky, it is not intended to replace them. Instead, it provides a broader framework for selected components of their theories.

PIAGET, VYGOTSKY, DEVELOPMENT, AND CULTURE

Reinterpreting Piaget: Age-Dependent Sensitive Periods for Cultural Learning

Beginning in the 1960s, cultural and cross-cultural developmentalists severely criticized Piaget for taking culture-specific sequences as universal (e.g., Greenfield, 1966; Cole & Scribner, 1974). By considering Piagetian theory from a cross-cultural perspective, I aim in this chapter to restore balance concerning Piaget's theoretical role in cultural psychology. I introduce the central idea that Piagetian stage theory has an important universal element as a theory of *innate potentials* and *age-dependent sensitive periods* for *cultural learning*.

The notion of age-dependent sensitive periods does lead to two important points of difference with Piaget and Inhelder (1969). The first is that, whereas they emphasize minimal ages for certain developments, the notion of age-dependent sensitive periods also implies constraints on the upper age for actualizing these same cognitive capacities. The really important difference, however, has to do with the issue of specificity/generality of stages. The sensitive period idea is that the original capacity for a particular kind of development can be general, but that the way in which it is actualized through cultural learning makes it more specific. The analogy is to language: human beings start out with a general capacity for language, but they learn specific ones. After they have learned a particular language, they, to some extent, lose their capacity to learn different ones. I make the case for this principle by using the example of concrete operations. The principle contrasts in a fundamental way with the Piagetian notion of domain-general stages.

By analogy with language, the sensitive period model of development leads to the hypothesis that, after culture-specific actualizations of a cognitive stage take place through experience during the optimal maturational window, other alternative actualizations become more difficult to acquire, even by the same experience later in development. This theoretical formulation leads to a definition of stages that is less general than Piaget and Inhelder posited. In my view, the sphere of application for a given stage becomes limited by the particular experiences that have actualized the maturational potential of that stage.

On the other hand, the concepts of innate potentials and age-dependent sensitive periods also have much in common with the view of Piaget and Inhelder (1969) on the role of maturation in development: "Where we do have some data, we see that maturation consists essentially of opening up new possibilities and thus constitutes a necessary but not in itself a sufficient condition for the appearance of certain behavior patterns" (p. 154). These maturationally given possibilities provide the potential for particular sorts of active construction to take place. In other words, the concept of age-dependent sensitive periods is in no way a statement of maturational reductionism. I would also agree with Piaget and Inhelder's important point that "Organic maturation is undoubtedly a necessary factor and plays an indispensable role in the unvarying order of succession of the order of the stages of the child's development" (Piaget & Inhelder, pp. 154–155).

Piaget and Inhelder (1969; Piaget, 1972) noted that acquisitions become more variable in their time of acquisition the further they are removed from their sensorimotor origins. I agree with this but would also go two steps further: (a) acquisitions become more variable (and therefore more culture specific) not only in their timing but also in their form the

further they are removed from their sensorimotor origins; and (b) as the forms of stage behavior become more variable and culture specific in the course of movement from sensorimotor to concrete operational to formal operations, so too do the forms of experience that are required to actualize each stage.

The notion of stages as sensitive periods for cultural learning does entail a major modificaton of the theory: no longer is the presence of a stage measured by its cross-domain applicability; stages are now by definition domain specific. Extrapolating from Piaget (1972), I believe that the culture and experience specificity of formal operations is greater than for the other stages. However, I would also assert that the principle of specificity still applies to concrete and even sensorimotor operations, although in progressively lesser degrees. My examples later in this chapter relate to the transition from pre-operational to concrete operational thought.

The Content of Cultural Learning: The Western Scientist as a Culture-Specific Developmental Outcome

The Piagetian concept of maturation contributes to a biologically grounded universal stage theory. However, because of the role of cultural learning in actualizing universal stages, Piagetian theory is also an *ethnotheory*, or a formalization of Western ethnotheories of development, that is, a folk theory of development. In using the term *ethnotheory*, I am asserting that scientists and lay people alike have some common cultural assumptions that enter implicitly and without awareness into the very foundation of both scientific and lay theories of development.

In the 1970s, I introduced the idea of Piagetian theory as a theory of the development of the Western scientist rather than of the universal individual (Greenfield, 1974/1976). I have since realized that Piaget himself asserted that understanding the basis for Western scientific thought was his most fundamental concern (Piaget, 1977). One can infer from this statement that Piaget saw his theory and research on child cognitive development as a way of understanding the developmental pathway to mature scientific thought. Alternative endpoints could have been selected. The ethnotheoretic aspect of Piagetian theory occurs in that aspect of the human condition Piaget selected as the endpoint of development (Greenfield, 1974/1976), not in the sequence of stages leading to that endpoint.

Piagetian theory, like the Western scientist, emphasizes the development of knowledge of the physical world apart from social goals. This corresponds to an ethnotheory of development in which cognitive knowledge is valued for its own sake, apart from the social uses to which it is put. This ethnotheory is typical of European-derived cultures (Mundy-Castle, 1974).

Needed: A Developmental Theory That Can Include
Cultures That Subordinate the Cognitive to the Social

Other cultures, however, have a different ethnotheory concerning the relationship between the cognitive and the social. They treat cognitive and social development as tightly integrated, with cognitive development subordinate to social development (Wober, 1974; Dasen, 1984). Such cultures see cognition not as a value in itself, but as a means to social ends. This is a view that is not encompassed in Piagetian theory. Even in Piaget's treatment of social cognition (notably, the work on moral judgment, Piaget, 1965b), the social is very much subordinated to the cognitive. The point here again concerns what is selected as the endpoint of development.

My assertion is that there are cultural differences in what constitutes the ideal, mature human being and that the nature of the ideal in Western European culture involves a scientific rationality that is superordinate to or independent of social relationships and social feelings. Because this ideal endpoint is taken for granted as the only possibility, it then automatically becomes what needs to be accounted for in a developmental theory that is created within this type of culture.

But what about Vygotsky? This is a subject to which I now turn. Vygotsky (1962, 1978) does, of course, have a sociocultural theory; it is the basis for the sociocultural component of the framework I am going to present. In Vygotsky's theory, the most important means to development is social interaction. For Piaget, the most important means is the child's experimentation with the physical world. Undoubtedly, one could link this difference in emphasis between Piaget and Vygotsky to cultural differences of the time. It does not seem coincidental that a greater emphasis on child development as a function of the sociocultural environment of the child arose in a communist country. This difference in learning mechanisms will be taken up in a moment.

However, for present purposes, I emphasize the commonalities between Piaget and Vygotsky that stem from the fact that both were steeped in the epistemology and culture of Western Europe. Both Vygotsky and Piaget have selected the same endpoint of development to explain and, not coincidentally, it is a cognitive one. In other words, even for Vygotsky, social interaction functions as a means to cognitive development. Development itself is defined cognitively, in terms of language and conceptual thought.

What is needed in our field is a formal theory of development that is broad enough to be fair to cultures in which the ethnotheory of development treats cognitive development as a means to social development, rather than vice versa. A first step would be to develop a theory of development for this alternative ideal endpoint: the person who has used his

or her cognitive capacities to become wise in social relations and to achieve social goals. However, if we were to take that route, we would simply have a second ethnotheory of development in a different sort of culture from our own. What is really needed is a theory that includes mechanisms for the differentiation of these two major developmental pathways. This is critical to the development of a truly universal theory, not merely one that claims universality on the basis of unwitting culture-specific assumptions.

Mechanisms of Cultural Learning: Vygotsky and Piaget

Both Vygotsky and Piaget present models of learning as well as of development. Vygotsky (1978) has an explicit model of socially guided learning. Piaget has an implicit model of discovery learning (Piaget, 1965a, 1977). I hope to show that, as theories of environmental learning, both the implicit theory of Piaget and the explicit theory of Vygotsky are more tied to specific sociohistorical circumstances than either theorist realized. I demonstrate that each model of learning describes adaptive responses to particular ecological circumstances. The notion is that both types of learning process are part of the universal armoire of developmental processes, but that each is selectively emphasized as a means of transmitting knowledge under different sociohistorical circumstances. Sociohistorical circumstances are seen, in turn, as having a strong economic foundation. The model that is dominant at a particular place or time does have implications for the learning processes of the individual learner, as I hope to demonstrate. Where guided learning is dominant, my hypothesis is that the learner comes to rely more on guidance as a means to acquire new knowledge and will tend to excel at learning and applying culturally normative modes of thought, action, and feeling. Where discovery learning is dominant, my hypothesis is that the learner becomes practiced at discovering new knowledge and will tend to develop individual creativity.

A THEORETICAL FRAMEWORK
FOR DEVELOPMENT

My goal in this chapter is to present an outline of a theory of development that:

1. Captures the relationship between biological maturation and culture-specific learning.
2. Provides insight into the relationship between social and cognitive development by exploring its cross-cultural variability.

3. Shows how mechanisms of learning and apprenticeship (and not merely the content of what is learned) are adaptations to particular sociohistorical circumstances and therefore vary over time and place.
4. Explains real-world phenomena.

Components of the Theory

The theoretical framework has the following four principal components:

- *Maturational component* : Age-dependent sensitive periods for cultural learning (Fairbanks, 2000; Fischer, 1987; Newport, 1988). Part (although not all) of this component is encompassed by Piagetian stages.
- *Sociocultural component:* The maturational component is actualized through communicative and linguistic interaction with other members of the sociocultural milieu (e.g., Heath, 1983; Ochs & Schieffelin, 1984) often mediated by activities and cultural practices (e.g., Scribner & Cole, 1981; Saxe, 1991; Rogoff, Baker-Sennett, Lacasa, & Goldsmith, 1995); tools (both concrete and symbolic; e.g., Bruner, 1964; Bruner & Olson, 1973; Greenfield, 1993); and values (e.g., Rabain, 1979; Shweder & Bourne, 1982; Greenfield, 1994).
- *Ecological component*: The sociocultural component is adapted to an ecological niche (e.g., Weisner, 1984; Whiting & Whiting, 1975; LeVine, 1977; Super & Harkness, 1997).
- *Historical component* (Scribner, 1985; Vygotsky & Luria, 1993): The ecological niche changes over time (Greenfield, 1999a, 1999b).

Each component has been studied individually and has a long history in the field, as the sample citations indicate. The news, both theoretical and empirical, lies in the specification of their interactions. These interactions are specified in the very definitions of the components, each of which directly interacts with the next one down in the hierarchy:

1. Culture is integrated with maturation: What matures are abilities to acquire different elements of culture through the sociocultural component of the model.
2. The sociocultural component is adapted to the ecological conditions.
3. Ecology changes over time.

An interdisciplinary approach, drawing on methods and concepts from psychology, anthropology, and sociology, is required to test the model.

APPLICATION IN A SMALL-SCALE, HOMOGENOUS SOCIETY: ZINACANTAN, CHIAPAS, MEXICO

Because the contextual components of the theory are so complex, the model can most easily be explored in a relatively small, relatively self-contained community over an extended period of ecological change. With my colleagues Carla Childs, Ashley Maynard, and Leslie Devereaux, I have been studying socialization in just such a community: Nabenchauk, a Zinacantec Maya village in Chiapas, Mexico. Our period of study goes from 1969 to 1995.

Interaction of the Maturational and Sociocultural Components

The focus here is on the interaction of universal age-dependent sensitive periods with cultural practices. The activity domain selected for this analysis is weaving, the most complex technology in traditional Zinacantec life. (See Fig. 10.1 for a statue of the ancient Maya backstrap loom, still used in Nabenchauk in 1997.) I begin with a physical component of weaving in order to provide a very concrete illustration of the interaction between maturational sensitivity and cultural experience. I then use Piagetian stage concepts to move to a cognitive example, where the analysis is more abstract and inferential.

The physical example has to do with the uses of the body in learning to weave (Maynard, Greenfield, & Childs, 1999). Note in Figs. 10.2 and 10.5 that, while a post forms one side of the loom frame, the weaver's body in a kneeling position forms the other end. My focus is on the physical skill of kneeling.

Kneeling is a universal biologically given capacity all human beings are born with. However, it can be maintained only by experience. This is demonstrated by Molleson's (1996) research in physical anthropology. By relating differential bone development in male and female skeletons to known gender differences in work activity at the same archeological site, Molleson shows that culturally defined experience in kneeling for many hours from a young age shapes bone development (e.g., flattens the two first metatarsal bones of both feet), so that the capacity to kneel for long periods of time is maintained into adulthood.

Zinacantec cultural practices provide just such experience for girls. Girls grow up watching their mothers and other older females sitting in a kneeling position with their legs under them during weaving and many other daily activities, such as making tortillas (Fig. 10.3) and changing a baby (Fig. 10.4). Cultural values come into play too; weaving, preparing tortillas, and child care are all highly valued activities that define women's work. Girls learn to maintain the kneeling position through cultural activities. Start-
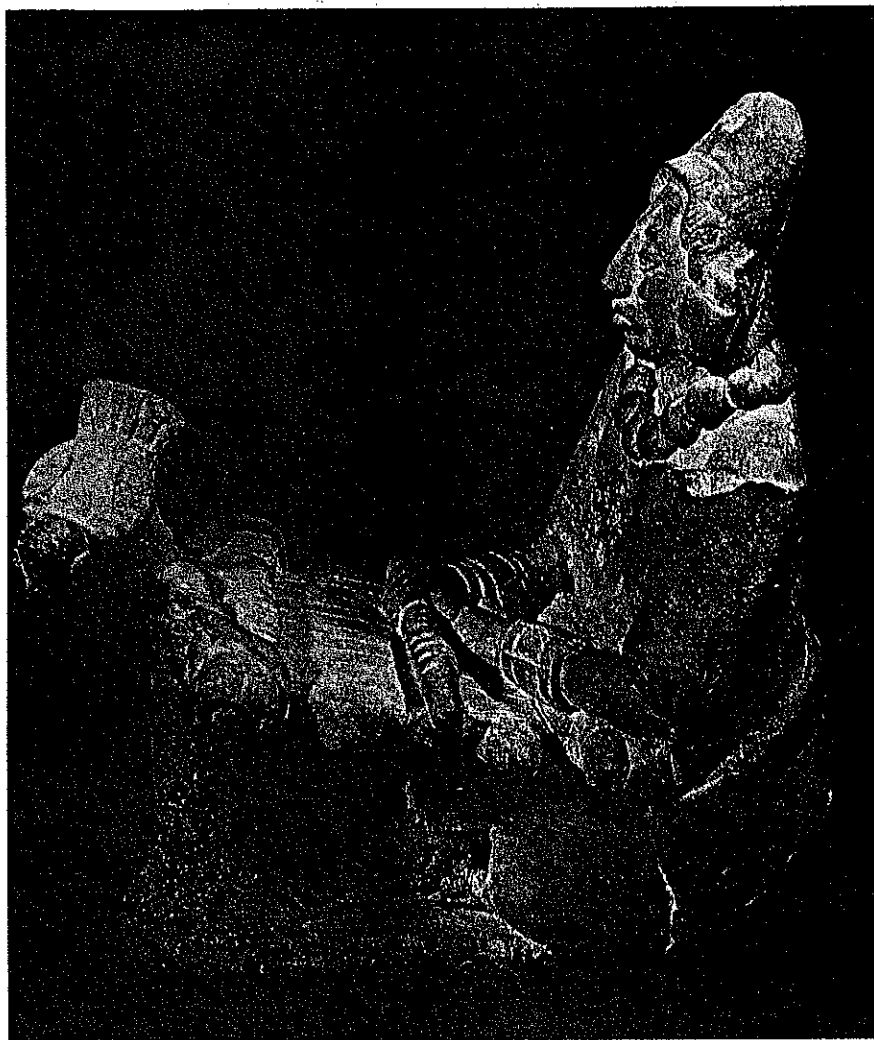
FIG. 10.1. Pottery figure of ancient Maya backstrap loom, Jaina, Campeche, A.D. 700–900. Photo courtesy of the Instituto Nacional de Antropologia e Historia.
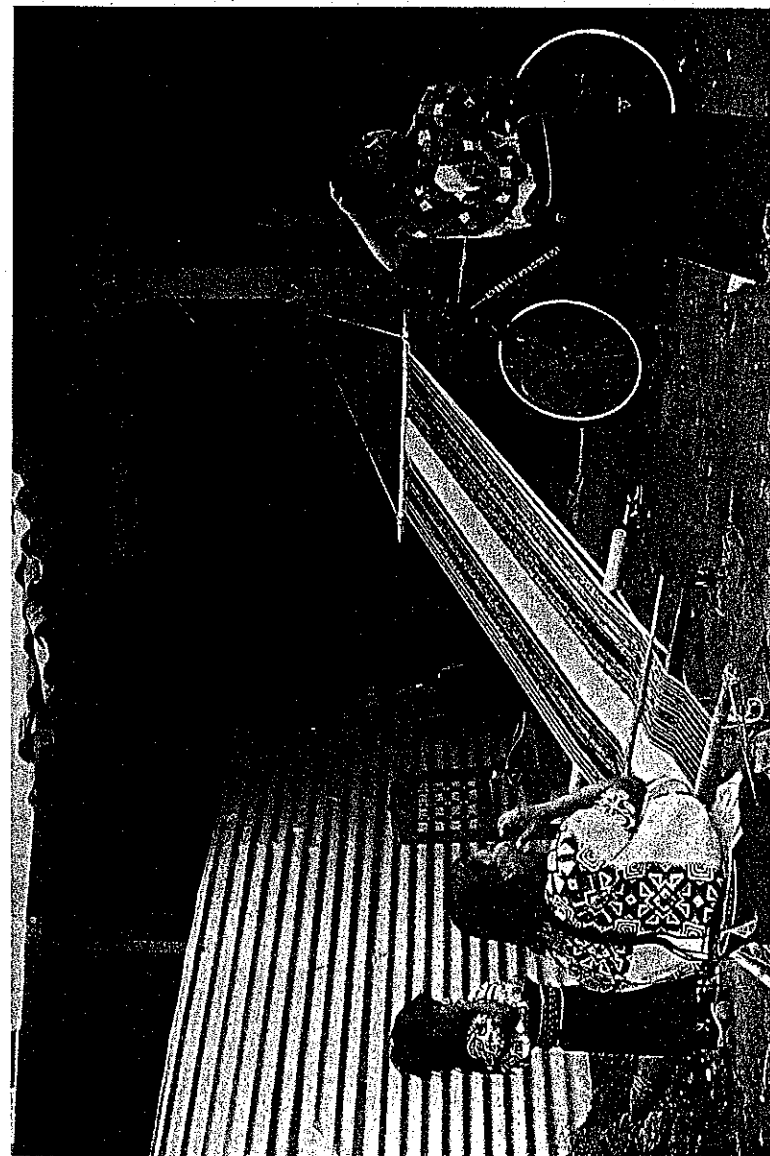

FIG. 10.2. Girl seated at the ancient Maya backstrap loom. Note that a post forms the right side of the loom frame while the weaver's body in a kneeling position forms the left end. Nabenchauk, 1995. Photo courtesy of Ashley Maynard.

ing at a young age, they kneel for many hours in a variety of situations and tasks, including play weaving at a toy loom, a traditional activity shown in Fig. 10.5, and newer activities such as creating designs for embroidered blouses, shown in Fig. 10.6.

The experience of my collaborator Ashley Maynard confirmed Molleson's conclusion that, without kneeling experience, the capacity
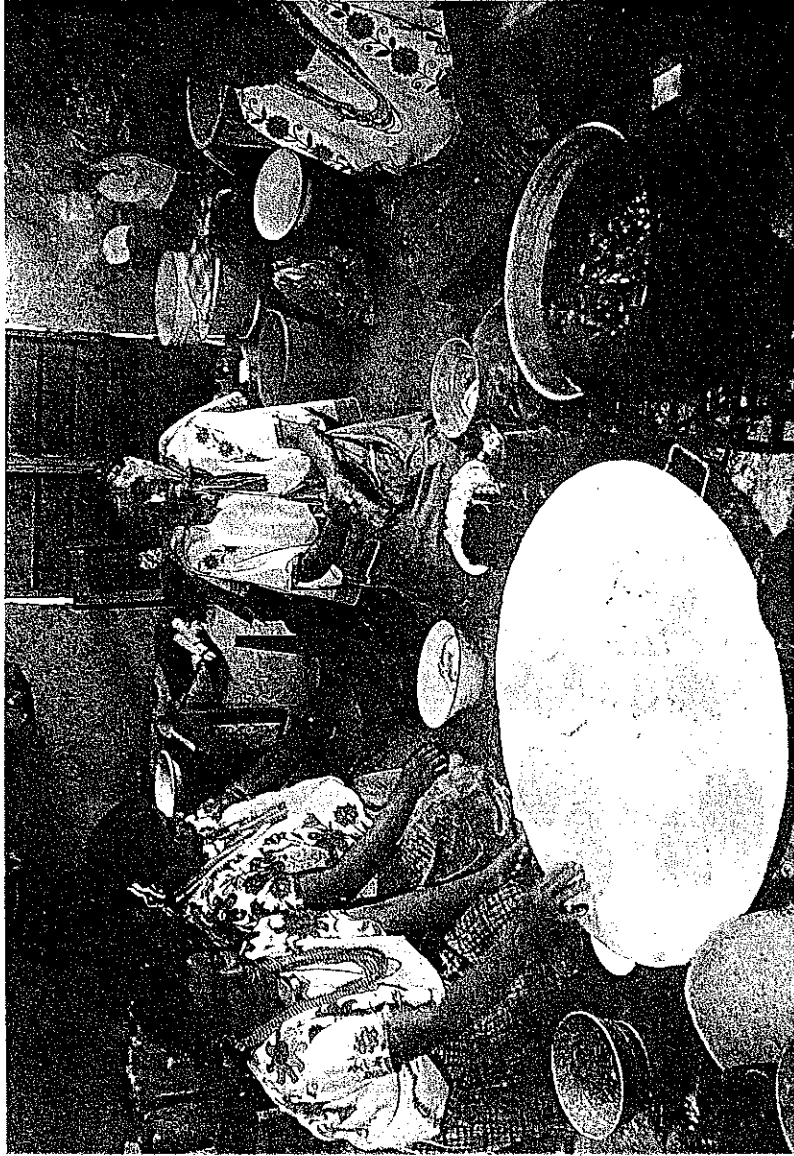
FIG. 10.3. Adult women kneeling to prepare tortillas. Nabenchauk, 1991. Photo courtesy of Lauren Greenfield.
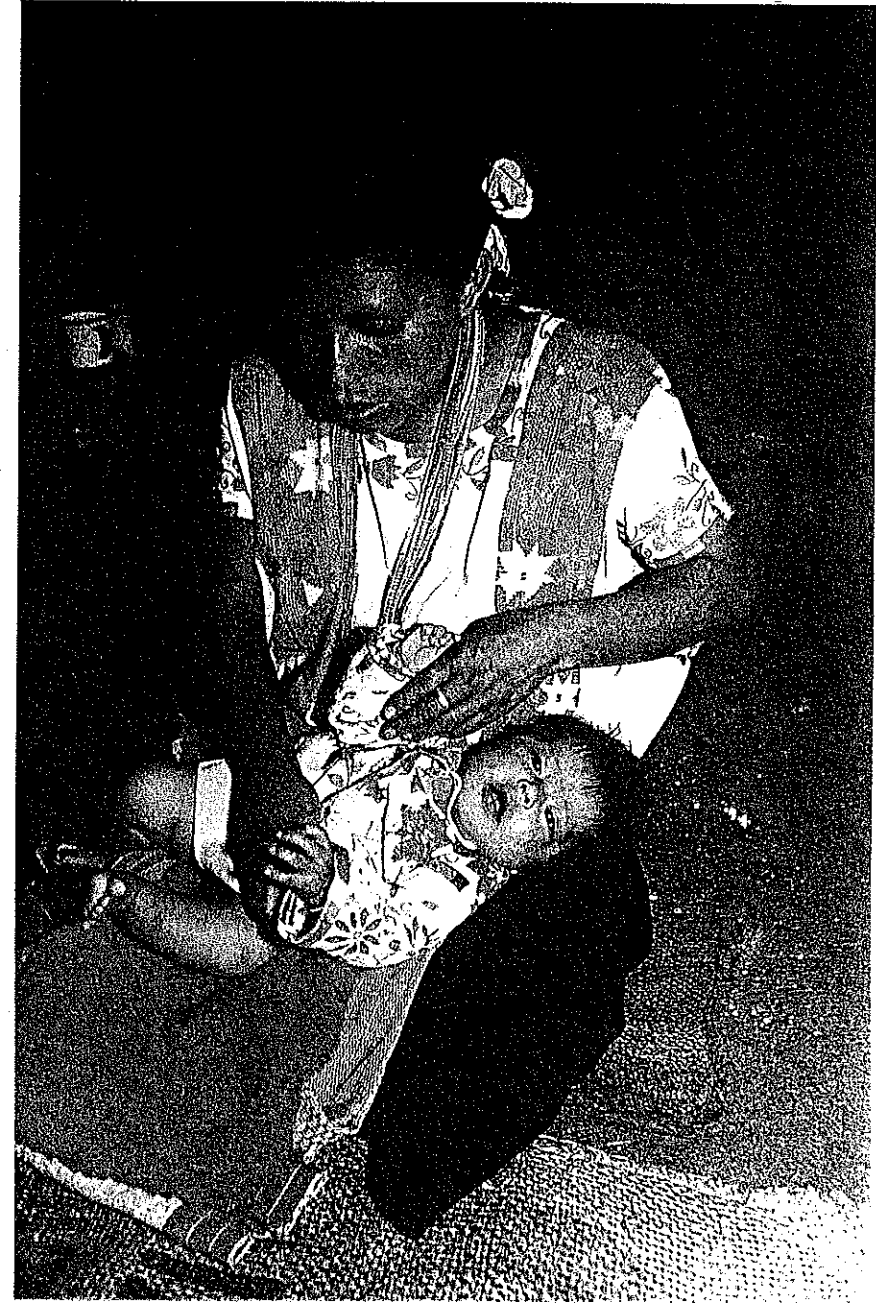

FIG. 10.4. Mother (Maruch Perez) kneeling to change her baby. Nabenchauk, 1991. Photo courtesy of Lauren Greenfield.
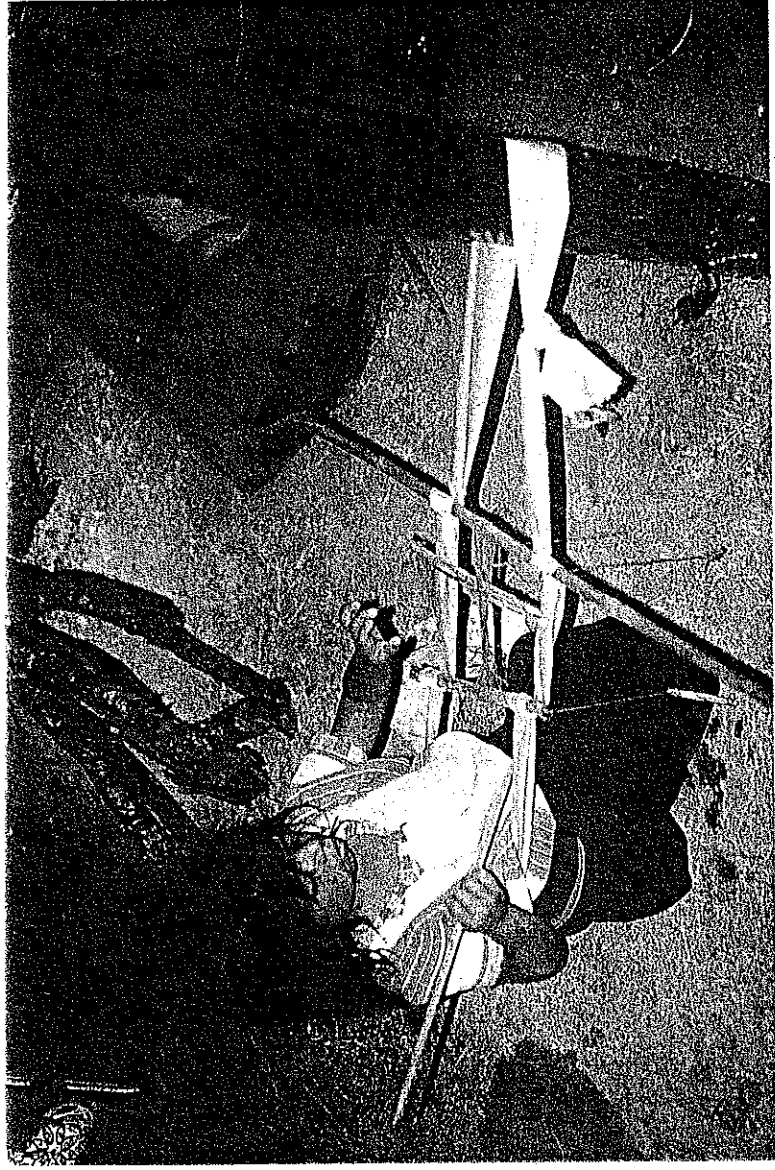
FIG. 10.5. Young girl (Rosy 1-209) kneels, as she engages in play weaving at a toy loom. Nabenchauk, 1993. (The numerals are to identify families from our larger, two-generation study of weaving apprenticeship, e.g., Greenfield, 1999b; Greenfield & Childs, 1996.) Photo by Patricia Greenfield.

FIG. 10.6. Girls (Loxa and Maruch 1-201) use the traditional kneeling position, even in newer activities such as drawing designs to embroider on their blouses. Nabenchauk, 1991.

FIG. 10.9. *Komen* or warping frame with warp threads already wound on it. Nabenchauk, 1991. Photo by Patricia Greenfield.
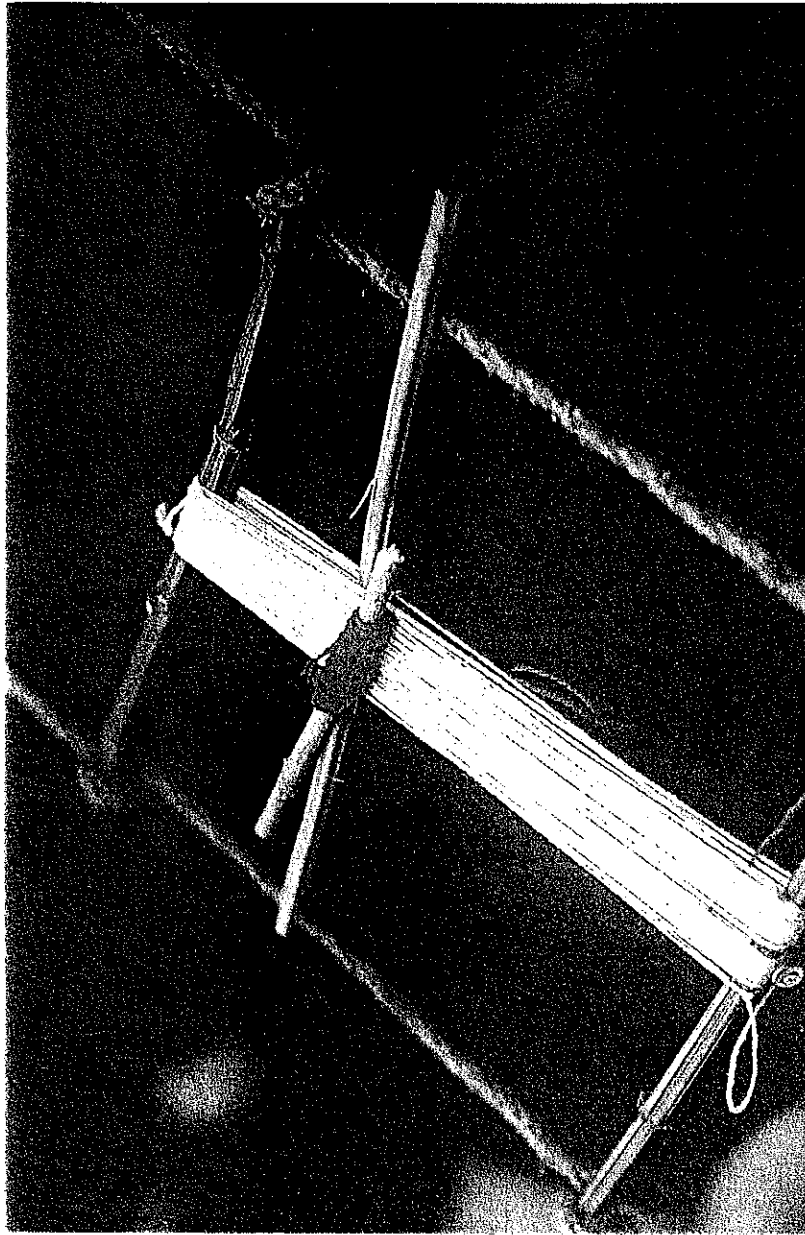
FIG. 10.7. Toy loom. The side ropes that hold the two frame sticks together while the warp (white threads) is being wound are visible. Photo courtesy of Lauren Greenfield.
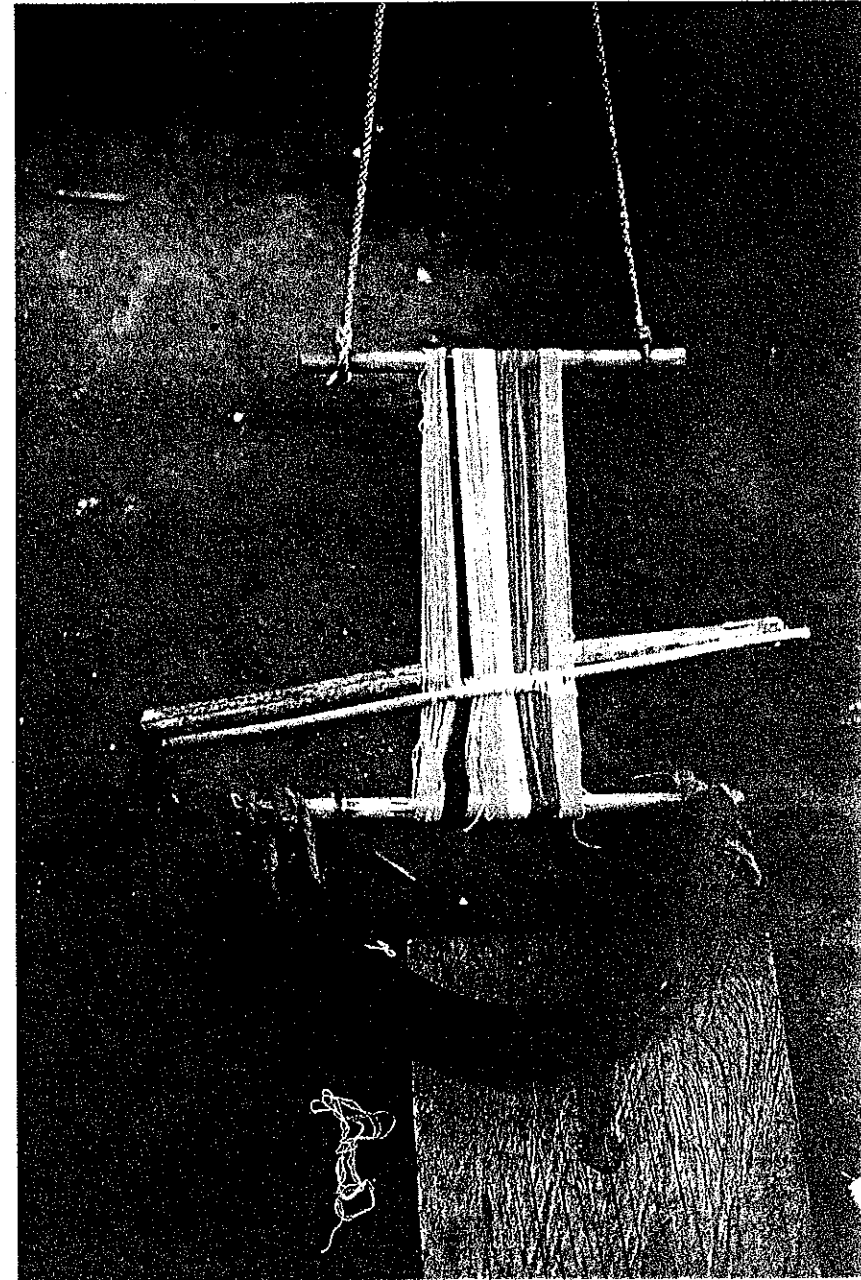

FIG. 10.8. Real loom. Note the absence of the side ropes; therefore, the warp threads hold the loom together. However, they cannot be wound directly onto the loom because the loom does not exist as connected sticks before the warp is wound.

FIG. 10.10b. A girl has begun to wind on the frame. Nabenchauk, 1995. Photo by Patricia Greenfield.
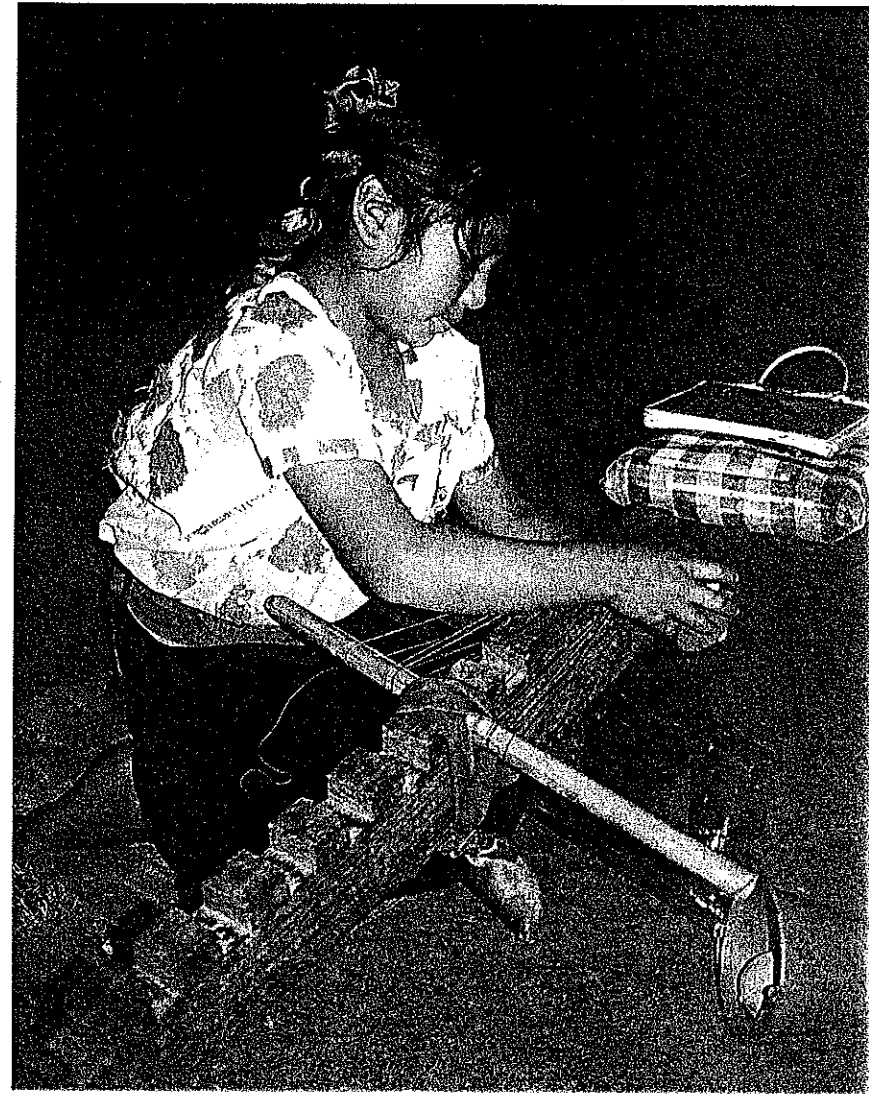

FIG. 10.10c. Girl has wound a few more threads. Nabenchauk, 1995. Photo by Patricia Greenfield.

to maintain a kneeling position for long periods of time can be lost with age (Maynard et al., 1999); Ashley was taught at age 23 to weave in Nabenchauk as part of an ethnographic study of weaving apprenticeship (Maynard, 1995). Unlike Zinacantec girls, she had not had extended and repeated kneeling experience at a young age, and, indeed, she encountered problems in learning to weave because she was not able to kneel for long periods of time. Kneeling was very painful for her and she resorted to sitting cross-legged, much to the derision of the Zinacantec teachers and other women who observed her weaving (Maynard et al., 1999). The absence of culturally mandated kneeling experience at a younger age had caused her to lose her ability to kneel for the long periods required by weaving. Her experience showed that there is a sensitive period during which this experience must take place.

Here I have used kneeling to demonstrate the interaction of biological sensitive periods with cultural practices. I now turn to more cognitive aspects of weaving, using Piagetian stage concepts. My thesis is that the timing of the transition from preoperations to concrete operations is a sensitive period, a developmental window, that is actualized differently in different cultures.

Developmentally Gradated Tools.   My theme here is that cultures have sets of artifacts and practices that respect and stimulate sensitive periods for cognitive and neural development. I argue that the developmental timing and order in which girls are exposed to various weaving tools show implicit knowledge of and respect for cognitive development. Specifically, these tools show implicit knowledge of the progression from the preoperational to the concrete operational stage and the timing of this progression. Vygotsky noted how much cognitive history is contained in cultural artifacts and that these artifacts function, in turn, as tools for the stimulation of current cognitive development (Scribner, 1985). I would like to take this line of thinking a step further: Not only cognitive history but also cognitive development can be contained in cultural artifacts. To provide evidence for this point, I analyze the cognitive requirements of a developmentally gradated set of Zinacantec weaving artifacts: the toy loom, the warping frame, and the real loom.

Play weaving on the toy loom, illustrated in Fig. 10.5, is widespread in Nabenchauk. It begins at age 3 or 4, in Piaget's preoperational period. It is used several years earlier than the real loom and warping frame; the latter is not used before age 6, the beginning of the concrete operational period. Preparing the real loom to weave on a warping frame is a concrete operational task, as I demonstrate later. Because the toy loom is just slightly different from the real loom, it does not require concrete operational thinking to set up. The difference lies in the ropes between the two

end sticks, one rope on each side (Fig. 10.7). By holding together the two end sticks (shown at the top and bottom of the loom in Fig. 10.7), these ropes permit the warp or frame threads (the white threads in Fig. 10.7) to be wound directly on the loom. Figure 10.5 shows how the end sticks that constitute the loom are connected by a loop of ribbon (functionally equivalent to the rope in Fig. 10.7) that goes around the weaver's back (hence the name *backstrap*) to the post; the tension necessary to keep the loom from collapsing is provided by the weaver, who leans back against the strap. Note that, unlike the real loom (Fig. 10.8), the top and bottom end sticks are connected by the ribbon looped around them. The real loom (shown in Fig. 10.8) does not have the side ropes (Fig. 10.7) or ribbons (Fig. 10.5) holding the loom frame (top and bottom end sticks) together. Note that only the warp threads (multicolored in Fig. 10.8) hold the two end sticks together. However, these threads cannot be wound directly on the loom (the two end sticks) because if the warp threads were not there, the loom would collapse; the loom has nothing to hold the two end sticks together before the winding of the warp threads begins.

Therefore, a real loom must have the warp prewound on a separate apparatus, the *komen*, or warping frame, shown (with a warp already wound on it) in Fig. 10.9. My thesis is that winding the warp on a *komen* intrinsically involves concrete operational thinking. This is the case because winding on the *komen* requires mental transformation, the essence of concrete operations (e.g., Piaget, 1963/1977). The form of the warp threads wound on the *komen* (Fig. 10.9) is quite different from the form of the threads on the final loom (Fig. 10.8). Complex topological transformation is required to understand the connection between how one winds the warp and how the warp looks and functions on the loom. Let me illustrate this point with a sequence of photographs.

Figure 10.10a shows a *komen* or warping frame, ready to begin winding. In Fig. 10.10b, a girl has begun to wind the threads on the warping frame; in Fig. 10.10c she has gotten a bit farther. Figure 10.10d shows a close-up of the resulting configuration of threads. Compare this image with Fig. 10.8. Figure 10.8 shows how the warp might turn out (with additional winding and more colors) after being transferred to the loom. Note the difference in the configuration of threads between Fig. 10.10d where warp threads are still on the warping frame, and Fig. 10.8, where the warp threads have been transferred to the loom. Threads on the left side of the stick in the warping frame of Fig. 10.10d go to one end of the loom (e.g., top end stick in Fig. 10.8), while threads on the right side of the stick in the warping frame of Fig. 10.10d go to the other end of the loom (e.g., bottom endstick in Fig. 10.8).

This sequence illustrates an important cognitive point: that a complex series of mental transfomations is required for a weaver to understand the connection between how the threads are wound on the warping frame and
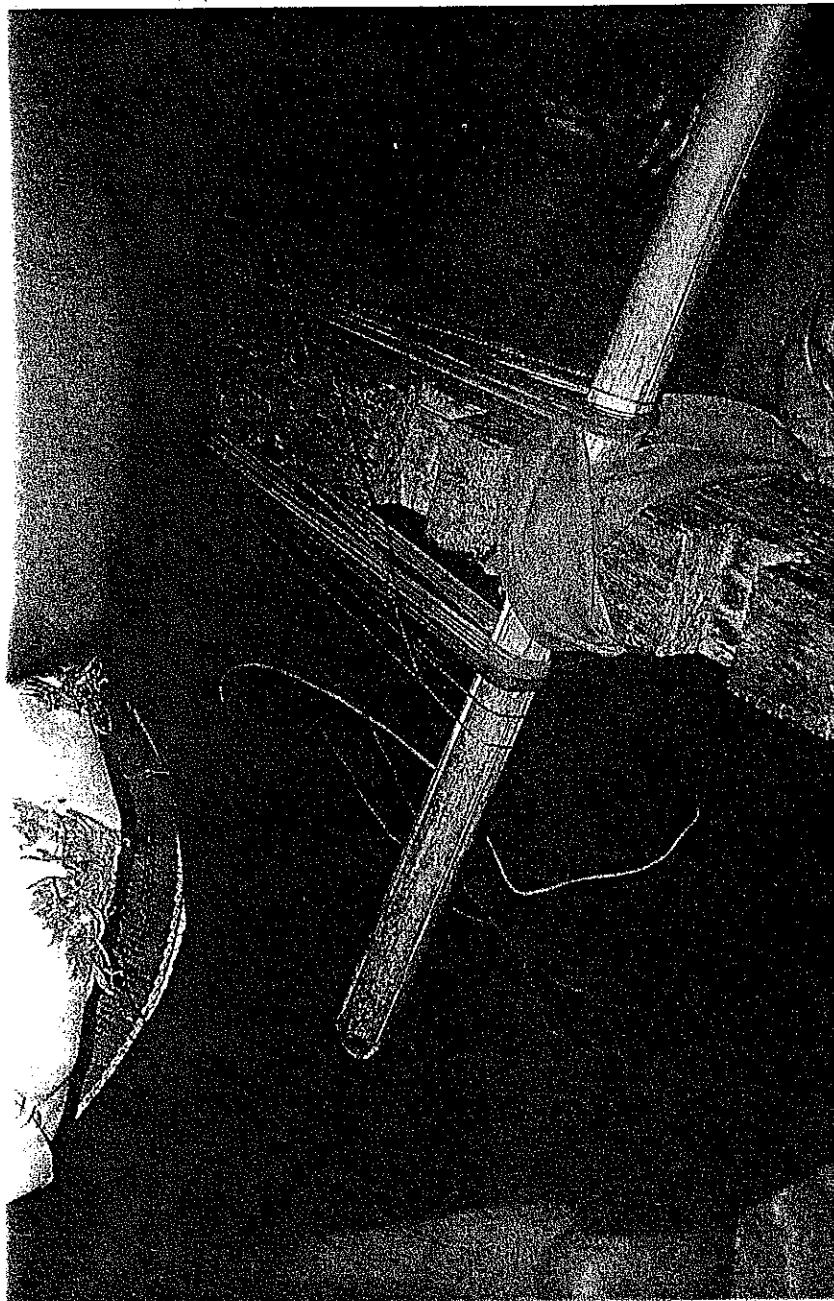
FIG. 10.10d. A close-up of the resulting configuration of threads. Nabenchauk, 1995. Photo by Patrica Greenfield.

how they end up in the configuration shown on the loom in Fig. 10.8. Because mental transformations characterize the Piagetian stage of concrete operations, winding a warp on the warping frame in order to set up a backstrap loom is a culture-specific concrete operational task.

I now compare the cognitive level required to set up a real loom with that required to set up a toy loom. Whereas to set up a real loom demands the mental transformations of concrete operations, mental transformations are not required for the toy loom. Because of the extra supporting rope or ribbon on the sides (Figs. 10.5 and 10.7), the warp can be wound directly on the loom. The sequence in Figs. 10.11a and 10.11b illustrates this central point. In Fig. 10.11a, a young girl has just started winding the warp directly on the loom, which is already set up. The top and bottom end sticks (left and right in the photo) are being held in place by white string connecting the sticks; one of the two side strings is shown clearly at the top of Figs. 10.11a and 10.11b.

In Fig. 10.11b, the young girl continues winding the warp between the endsticks, seen in the photograph. In Figs. 10.11a and 10.11b, the warp threads are being wound into their final position between two endsticks. similar, for example, to the way warp threads are stretched between end-sticks on the looms shown in Figs. 10.7 and 10.8. Unlike winding the warp on a warping frame, there is no mental transformation required to go from the winding process to the set up loom.

The important conclusion from this analysis is that Piagetian theory is part of the Zinacantecs' implicit ethnotheory of development. Whereas Zinacantec girls start on the toy loom from age 3, they do not set up a real loom before age 6 at the earliest, the beginning of the normal age range of concrete operations. So, most interestingly, Piagetian theory is implicitly (but not explicitly) built into the developmental progression of Zinacantec weaving tools. If one thinks of Piagetian stages as age-dependent sensitive periods, then learning how to set up a real loom using a warping frame can be seen as an activity that actualizes concrete operations in a culture-specific form.

Cognitive Stages as Age-Dependent Sensitive Periods. What is the evidence for Piagetian stages as age-dependent sensitive periods and how does play weaving fit into this picture? I should like to draw upon a new theory of primate play by Fairbanks (2000) and propose that it applies both to human play in general and to play weaving in particular. Fairbanks (2000) has developed a theory of monkey play that posits the role of play in stimulating neuromuscular pathways that underlie particular adult monkey skills. She contrasts her theory with the theory that play functions as direct practice of an adult behavioral skill. She observes that because the height of each monkey-play form occurs years before the adult behavior, it would not

FIG. 10.11a. A young girl has just started winding the warp of her toy loom. Nabenchauk, 1995. Photo by Patricia Greenfield.
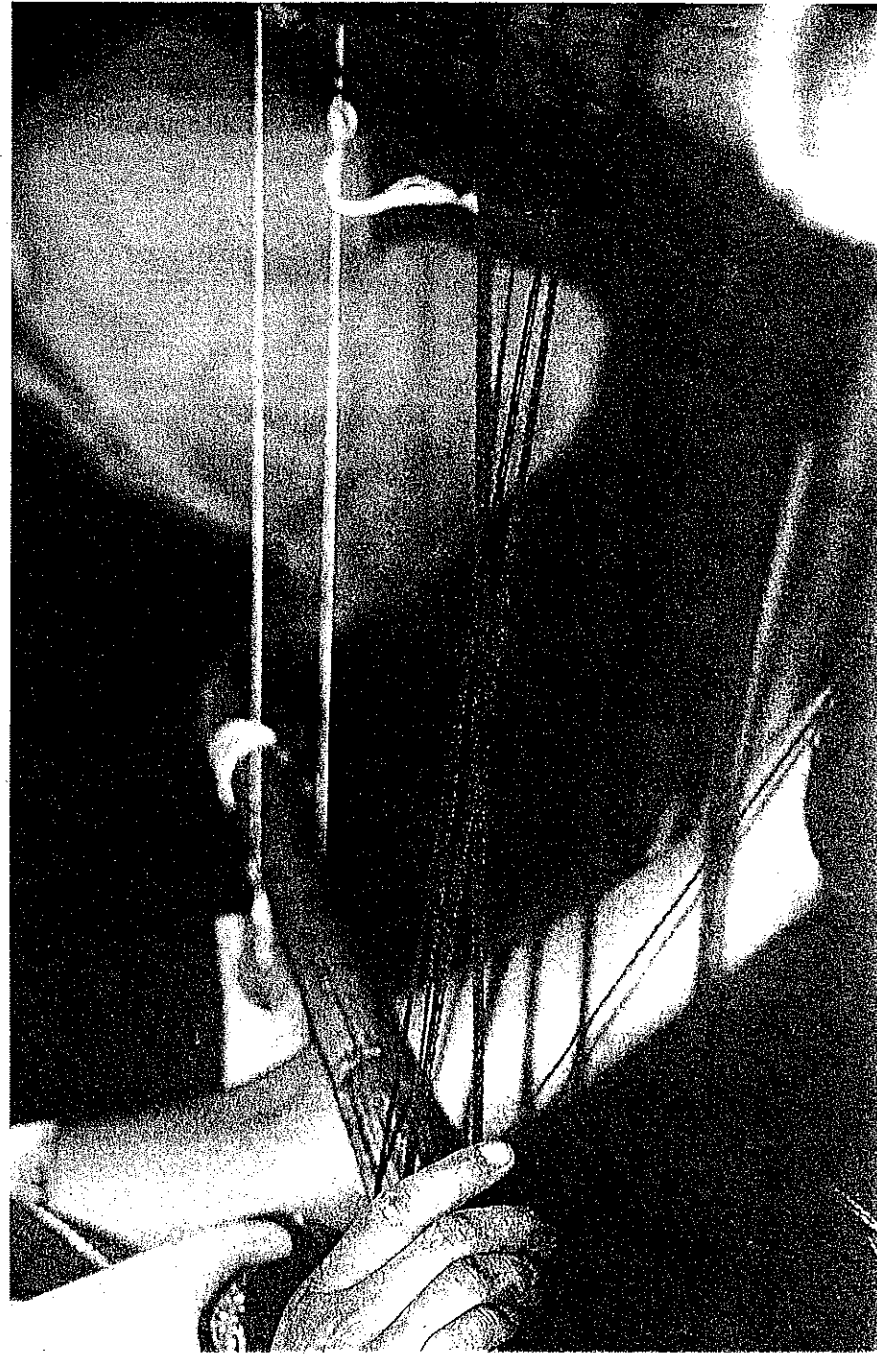
be very useful as practice for the adult behavior. However, the playful form is most frequent just at the time the relevant neural substrate for that particular activity is developing. For example, play fighting in monkeys reaches its maximum just as the neural circuitry for adult aggression is developing, but years before aggression is required in adult monkey social life.

Could this analysis apply to human play in general and to play weaving in particular? There are several parallels with Fairbanks' theory and data. First, there is the behavioral parallel: just as play fighting occurs in monkeys several years before the real thing, so does play weaving on the toy loom occur several years before weaving utilitarian items on the real loom. Second, Thatcher (1994) presented electroencephalogram evidence for spurts in neural development. These spurts are periods of neural instability that serve as developmental transition points in the nervous system. One of these transition points or spurts is at age 4 (Fischer & Rose, 1994), in the age range when play weaving begins.

My theoretical interpretation of these transition points in neural development is that they are sensitive periods—developmental windows—when stimulation, often in the form of culture-specific practices, actualizes maturationally specific neural circuits. It follows from this that play weaving could stimulate neural and neuromuscular pathways that provide a foundation for the later cognitive development required to weave on a real loom.

Fischer and Rose (1994) identified a second spurt in neural development that occurs between 6 and 10 years of age. This is precisely the period in which weaving on a real loom begins for most Zinacantec girls. It is also Piaget's period of concrete operations, which, as I have tried to illustrate, are indeed required for setting up a real loom. Hence, this spurt of neural development could provide a developmental window for the culture-specific actualization of concrete operations.

The Role of Values.   One aspect of values relevant to this theory is the ethnotheory of development to which Zinacantecs connect weaving. First, they are in agreement that development is important: a girl will weave when she has enough soul (implies can listen to instruction, follow instruction, do what is needed and tolerate frustration), and this takes time to develop (Devereaux, personal communication, 1991). However, there is something different here, different both from our ethnotheories of development and from our formal theories of development (specifically those of Piaget and Vygotsky). According to the ethnographic research of Devereaux, Zinacantecs do not value weaving as a technical skill; rather, they value weaving for its social aspects: "the social interactional aspects of the learning process," the social utility of what is woven, and the enhancement of a girl's marriageability by being a good weaver.

To compare this with our ethnotheories and theories of development, the Zinacantecs do not have separate theories of cognitive and social development. For them, cognitive development is embedded in and subordinate to social interaction and the development of social activity. So, for example, one mother told us that her mildly retarded child (my diagnosis) would not be able to learn to weave. However, she explained, this was fine because the daughter had another useful job, putting thread on spools. It was not important to her that this job was cognitively much simpler than weaving. What mattered was that it made a contribution to the family. My point is the following: Cognitive development may follow a common pattern across cultures, but the value attached to it does not.

This subordination of cognitive skills to social relationships and goals is part of a system of values that emphasizes social interdependence in the definition of the self (Greenfield, 1994; Markus & Kitayama, 1991); this system of values is often called *collectivism* (Triandis, 1989). The emphasis on an individual's knowledge and technical expertise for its own sake is part of a system of values that emphasizes independence and autonomy (Greenfield, 1994; Markus & Kitayama, 1991; Mundy-Castle, 1974). Consistent with this value system, we, in the United States, for example, might value backstrap loom weaving if we thought it stimulated the development of concrete operational thought. However, this is not at all the way the Zinacantecs think about weaving. Instead, Zinacantecs are more interested in the social function than in the purely cognitive aspects of weaving. Zinacantec culture contrasts with ours in this respect.

Weaving Apprenticeship in Sociocultural Context.   Let me illustrate the weaving apprenticeship practices in 1970, the year we did our first video study (Childs & Greenfield, 1980). In the course of the apprenticeship process, maturational readiness for Piagetian stages was met with Vygotskian scaffolding (Greenfield, 1984; Wood, Bruner, & Ross, 1976). Help in completing the novice's weaving task was provided by an expert, usually the mother. The interindividual activity theorized by Vygotsky (1978) is beautifully exemplified by a controlled, historical case study of two generations in a single family. This case illustrates the interaction of maturational readiness with the process of sociocultural construction.

Katal, age 9, was taped as she learned to weave in 1970. Throughout our videotaping of her weaving apprenticeship, Katal's mother, Xunka', serving as her teacher, was actively engaged in a process of scaffolding (Fig. 10.12). Xunka' was constantly anticipating her daughter's need for guidance and helping her to complete a weaving the daughter could not do on her own. For example, at one point during the taping, the mother entered the scene without being summoned, the teacher initiating help on her own. In anoth-

FIG. 10.12.   Video frame of Katal's mother, Xunka', helping Katal 1 to weave. Nabenchauk, 1970. Video by Patricia Greenfield.

er typical instance of weaving scaffolding, Fig. 10.13 shows four hands on the loom; two belong to the learner, two to the teacher. This image symbolizes a paradigmatic interindividual process and demonstrates the interdependence of learner and teacher in weaving apprenticeship in 1970 (Greenfield, 1999).

We also noted that this highly scaffolded process of apprenticeship left little room for error. In fact, errors were to be avoided because weaving materials were costly and difficult to obtain. This is one aspect of the ecological component to which the socializing process of apprenticeship is adapted.

Correlatively, this highly scaffolded process of apprenticeship left little room for discovery. This was a quality well suited for the maintenance of weaving tradition in a society in which learning to weave meant learning to weave a closed stock of about four traditional patterns. Because the teacher was the mother, a member of the older generation, this example of weaving apprenticeship also illustrates the flow of authority from elder to younger members (Greenfield & Childs, 1996). The collectivistic values of interdependence and respect for the authority of elders were implicit (although not explicit) in Zinacantec weaving apprenticeship.

FIG. 10.13.   Video frame of four hands on the loom, Katal 1 and her mother. Nabenchauk, 1970. Video by Patricia Greenfield.

Ecological Component: The Sociocultural Component Is Adapted to an Ecological Niche

Reverence for stable tradition was related to the functionality of authority in agrarian societies, where the older generation controlled land, the essential means of subsistence and production (Collier, 1990). There was an absolute view of the world. For example, when I asked why a group of Zinacantecs were dressed like us rather than like them, the answer in Tzotzil was, "They don't know how to dress." Innovation was a negative. To be different was to gather opprobrium. This was a value interpretation. However, note that it is primarily in a situation of value conflict, such as the flouting of the Zinacantec dress code, that values move from the implicit to the explicit level. Weaving was part of a collectivistic value system that emphasized interdependence in social relations, as well as respect for authority and cognitive skills in the service of social goals. This value system was well adapted to life in a subsistence, agriculturally based economy, in which the younger generation depended on the elders' land and in which cooperative exchanges of labor were required for the production of food and clothing.

Historical Component: The Ecological Niche Changes Over Time

In the decades from 1970 to the 1990s, there have been significant economic changes in the culture of Nabenchauk. Zinacantecs have moved from an agrarian, subsistence culture to a commercial society, from family- and community-held land to individually owned trucks and vans. Commerce promotes individualistic practices because nuclear family members are regularly moving in every direction independently of each other. For instance, a child may go to a nearby market to sell fruit with a neighbor, or a father may drive 18 hours one way to pick up some commodity to be sold. Members of a nuclear family operate more and more independently of each other as their involvement with commerce increases.

Even weaving has been commercialized. Woven textiles are sold both to outsiders (see Fig. 10.14) and to other Zinacantecs. In Fig. 10.14, woven and embroidered *servilletas* (napkins) are for sale to tourists and others who stop to buy; the *servilletas*, seen hanging in the background, are an item specially developed to sell to outsiders.

This type of entrepreneurship is part of a pattern of innovation and individualism. Innovation is seen in the change from a small closed stock of traditional woven patterns to a constant process of pattern innovation; each woven artifact is now unique, a mode of individual expression. For example, instead of a situation in which all males wear the same poncho (Fig. 10.15), we found an infinite variety of designs, giving a larger role to individual creativity and uniqueness (see Figs. 10.16a, 10.16b, and 10.16c). Although the style and background pattern of red and white stripes has stayed the same, the woven and embroidered decoration is distinct for each poncho, and this decoration is getting increasingly elaborate; this can be seen by comparing Fig. 10.16a (poncho from 1991) with Fig. 10.16b and Fig. 10.16c (ponchos from 1995); (Greenfield, 1999a, 1999b; Greenfield & Childs, 1996). Thus, the developmental outcome in terms of artistic expression has changed. Artistic expression has become more individualized.

This societal level of historical change also brought with it a change in the cultural practices concerned with weaving apprenticeship. This was revealed by our study of the next generation. Recall the case of Katal, who was learning to weave under her mother's tutelage in 1970 (Figs. 10.12 and 10.13). She grew up and had children of her own. In 1991, one of them, Loxa, was about the same age her mother had been in 1970, and we were able to study how she learned to weave. As with her mother, we again made a videotape of her weaving apprenticeship. Figure 10.17 presents a frame from the tape that is typical in many respects. Comparing Figs. 10.12 and 10.13 (mother learning to weave in 1970) with Fig. 10.17 (daughter learning to weave at same age in 1991), some differences are striking. Note that

FIG. 10.14. Woven and embroidered *servilletas* (used as tortilla covers, place mats, or hand towels) are for sale at a roadside stand. A Zinacantec woman makes a sale to an outsider, as her young daughter looks on. Nabenchauk, 1991. Photo courtesy of Lauren Greenfield.
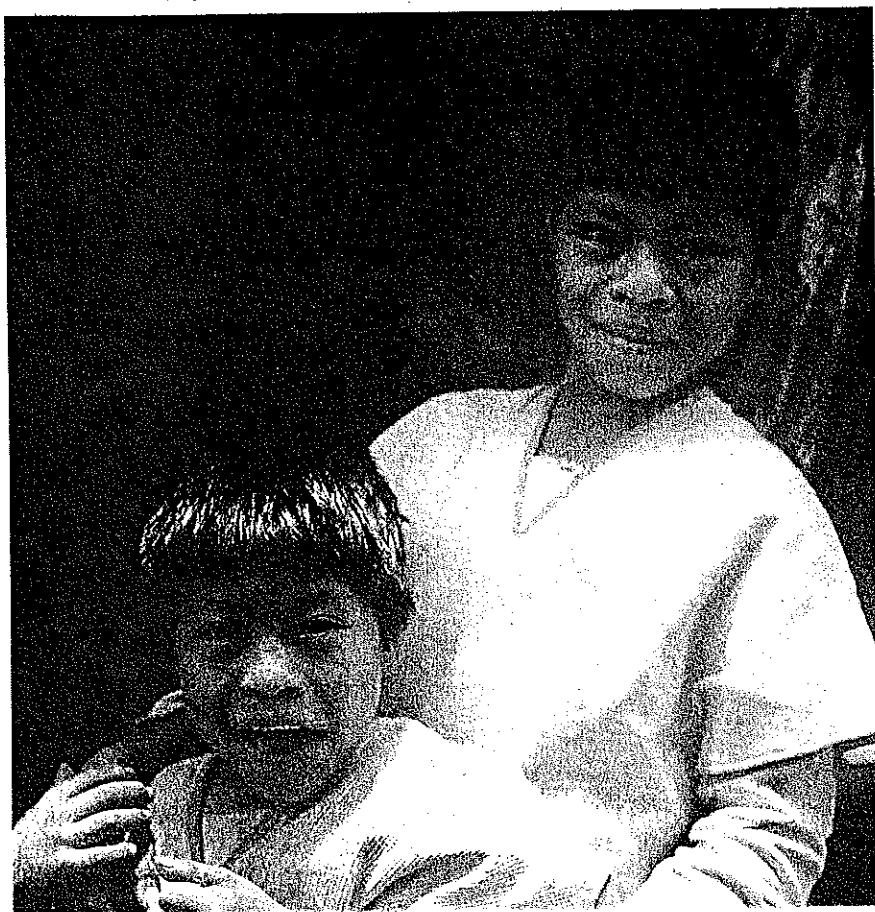
FIG. 10.15.   Pavlu brothers; both are wearing virtually identical ponchos. Nabenchauk, 1970. Photo courtesy of Sheldon Greenfield.
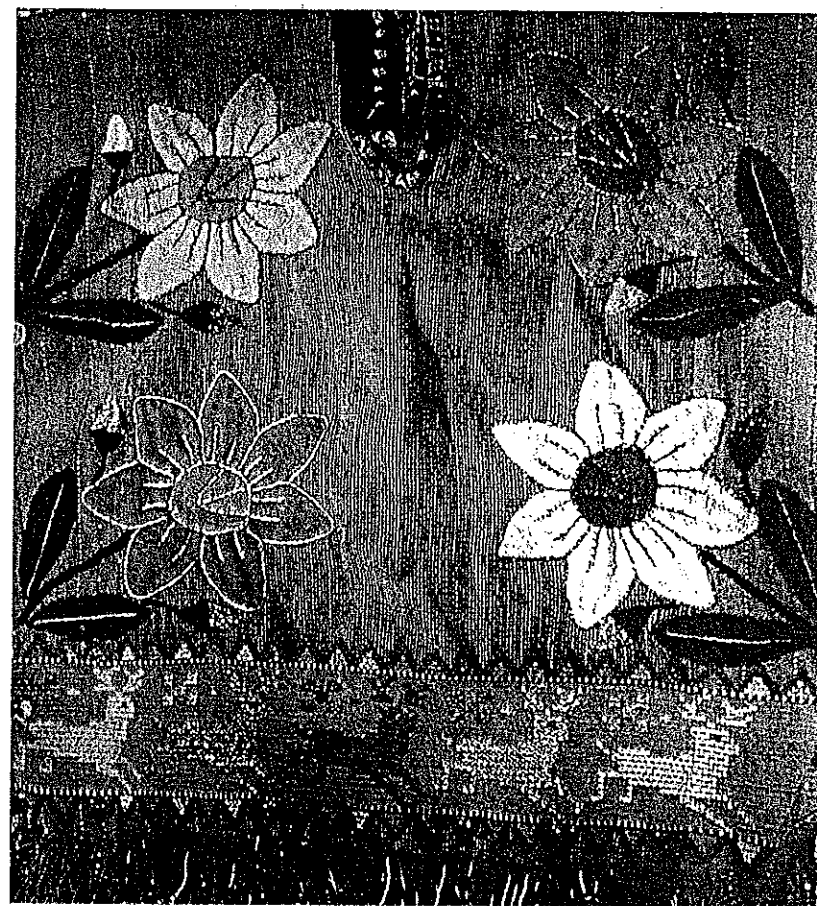
FIG. 10.16a, b, and c.   Three distinctly different ponchos from the 1990s.
FIG. 10.16a.   Poncho from Nabenchauk, 1991. Photo courtesy of Lauren Greenfield.

in contrast to the previous generation (Fig. 10.12 and 10.13), Loxa's mother is not present in the frame. Instead, mother has assigned Loxa's older sister, Xunka', to serve as teacher. This change in the generation of the weaving teacher is related to the historical increase in innovation; that is, weaving innovation is concentrated in teenage girls.

In addition, the learner has become much more independent. Unlike her mother's teacher, Loxa's teacher does not anticipate her need for help. Note that the older sister is paying no visual attention to the weaving learner in Fig. 10.17; she is also much farther away from the learner than the teacher in Fig. 10.12 and 10.13. The learner must take the initiative to summon her teacher when help is required. The scaffolding

process is directed by learner rather than teacher. There has been a move ment from interdependence to independence of learner and teacher. I fact, the movement has been toward the independent discovery learnin; favored by Piaget (1965a) and away from the scaffolded guidanc(described by Wood, Bruner, and Ross (1976), based on Vygotsky's (1978 theory (R. Gelman, personal communication, 1991).

This method is adapted to a situation where errors are less costly, an(innovation and discovery are valued. Earlier, I noted that innovation i woven patterns had come to be valued. In fact, errors had become les costly too. There had been a switch from the more expensive (to buy) co ton and the more expensive (to produce) wool to the cheaper acrylic, :
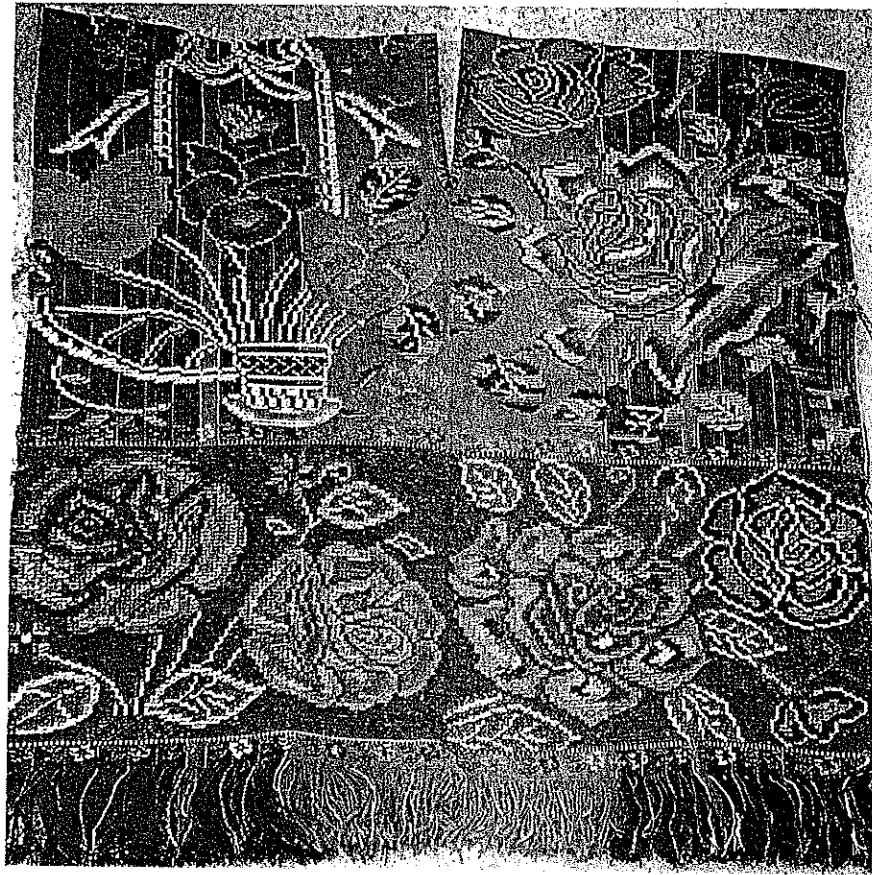
FIG. 10.16b.   Poncho from Nabenchauk, 1995. Photo by Patricia Greenfield.

FIG. 10.16c.   Poncho from Nabenchauk, 1995. Photo by Patricia Green-field.

petroleum-based product of the 1980s oil boom in Mexico. In addition, the development of a transport business and the local commerce that followed made the materials (thread) easier to get. Whereas in 1970, cotton thread had to be purchased retail in the city of San Cristóbal, acrylic thread could now be purchased wholesale in San Cristóbal and resold retail in Nabenchauk. In other words, as materials became more plentiful, easier to get, and cheaper, errors became less costly over the same historical period in which apprenticeship changed (cf. Rogoff, 1991).

Theoretical Conclusion and Summary.   A general theoretical conclusion follows. In circumstances where the goal of apprenticeship is to maintain tradition and avoid error, the Vygotskian model of socially guided learning is dominant; in circumstances where innovation is desired errors are not too costly, the Piagetian model of independent discov learning is dominant.

Note that there is still a process of sociocultural construction of w ing skill by which the maturational potential of a 9-year-old for conc operations is actualized in backstrap loom weaving. But the nature of sociocultural process has been transformed in this particular family.

FIG. 10.17. Video frame of Katal 1's daughter, Loxa 1-201, learning to weave in 1991. Loxa is about the same age as her mother was when she was videotaped learning to weave in 1970. Nabenchauk, 1991. Video by Patricia Greenfield.

Testing Generality and Integrating Levels of the Theoretical Model: Structural Equation Modeling

Was the observed historical change general? If so, was the change in fact mediated by the hypothesized change in ecological conditions? We used interview and demographic census data, plus structural equation modeling, to answer these questions (Greenfield, Maynard, & Childs, in press). Such a model also takes account of within-culture individual differences in a way that a paradigmatic case study cannot.

Figure 10.18 presents a structural equation model (Bentler, 1989) that represents our results well. Several levels and aspects of the theoretical model are represented in this model and their interaction is represented quantitatively. The causality goes from the more distal and abstract to more proximal levels of influence, ending with the apprenticeship process. For this reason, structural equation modeling is well suited to test this type of multilevel theory. The model is based on 72 subjects from two generations, those girls observed learning to weave in 1970 and those observed learning to weave in 1991 or 1993.
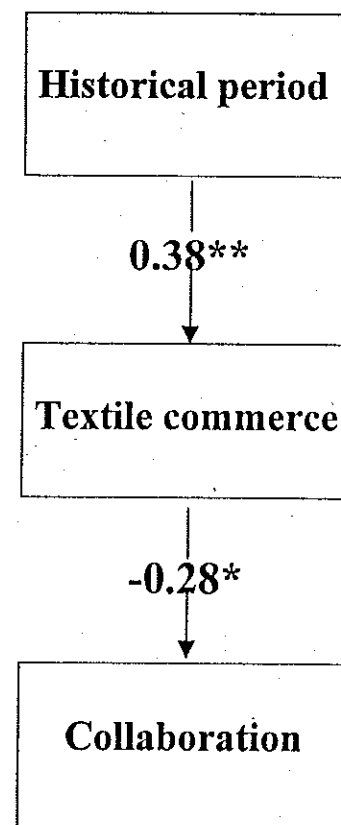
FIG. 10.18. Structural equation model of the role of historical change and economic development in weaving apprenticeship. **$p < .01$, *$p < .05$, (Greenfield, Maynard, & Childs, in press).

Historical Level.   Top of the model: Was the girl a learner in 1970 or in the 1990s?

Ecological Level.   Next level down: How involved was the girl and her mother in textile commerce? This involvement was measured by a textile commerce scale that assessed the involvement of a girl and her mother in various aspects of textile commerce (Greenfield, Maynard, & Childs, in press). Sample scale items included selling *servilletas*, as in Fig. 10.14, and weaving on order for another Zinacantec.

Sociocultural Level.   How much collaborative activity on the weaving was there between teacher and learner? More, as in Figs. 10.12 and 10.13, or less, as in Fig. 10.17? We took collaborative activity as an index of interdependence.

Looking at Fig. 10.18, first note that each level, starting at the top, has a causal influence on the one below. Thus, historical period has a causal influence on weaving commerce; there is less commerce in the earlier period. Weaving commerce is, as hypothesized, a mediator between historical period and style of weaving apprenticeship. Note the excellent fit of the model to the data (Comparative Fit Index = 1.00, the maximum value) and the fact that each individual link is statistically significant.

A structural equation model allows individual differences to be part of a cultural model. Let me point out, for example, that there are individual differences in the ecological level. Note that historical period is not sufficient to predict apprenticeship. Individual variation in the ecological level not predicted entirely by historical period is also important. As the three levels of the model in Fig. 10.18 show, the relationship between historical period and apprenticeship is mediated by commerce. This is because commercial activity is not totally correlated with historical change; historical movement to a commercial way of life has been uneven within the population of Nabenchauk as a whole and even within the sample. This individual variability (and uneven social change) is captured by the weaving commerce scale. It is reflected in individual differences at the next level.

On the sociocultural level, textile commerce is causally related to teacher–learner collaboration in weaving apprenticeship (bottom arrow in Fig. 10.18). The more involved a girl and her mother are in textile commerce, the more frequently the teacher and learner work together, as in Figs. 10.12 and 10.13. This causal relationship is represented by the lowest arrow in the model shown in Fig. 10.18.

Uneven Social Change and Value Conflict: Interaction Between the Sociocultural and Ecological Components

In a situation of uneven social change, some people have changed considerably toward the new more individualistic cultural practices; others have changed much less. In this situation, one might expect some conflict between the two models of learning and apprenticeship. I now want to present some ethnographic evidence for conflicting mental models of the apprenticeship process. In the conflict, we see how underlying values are made explicit in the interpretive process of verbal discourse.

A little girl, Rosy, age 7, had spontaneously set up a toy loom. A teenage girl next door saw Rosy working, decided what she was doing was not good, and came over and undid everything. In Fig. 10.19, the teenage neighbor is in the middle of taking out Rosy's warp (frame threads). At this point it is important to present ethnographic evidence for conflicting mental models of the apprenticeship process. Clearly, the teenage neighbor felt that Rosy should not make her own mistakes. Of Rosy's warp, she

made the evaluative comment "bad." Rosy's mother had another model in mind: independent learning. "Let her do it by herself," said Rosy's mother, Maruch. "She doesn't know how," replied the self-appointed teenage teacher. This reply reflected the older model of scaffolded, relatively errorless learning, in sharp contrast to the mother's model. Later, Rosy's mother elaborated her model even more explicitly. She told me that it was better for Rosy to learn by herself, as her older sister had done. She had neither helped nor talked to Rosy's older sister, said the mother.

It is interesting that Rosy's family was much more heavily involved in commerce than was the neighbor's family, so the conflicting models also represented the two ecologies identified in the structural equation model (Fig. 10.18). Later, I asked Rosy about her own model of learning: Did she want to weave by herself or with help? She replied, "By myself." Upon further questioning, she added that it was "worse" to have the girl help. So Rosy, like her mother but unlike her self-styled teacher, had in mind the newer model of more independent apprenticeship.

EXTENSION OF THE THEORETICAL FRAMEWORK TO A MULTICULTURAL SOCIETY

We see learning to weave as but one example of two contrasting models of development mentioned earlier. These models, which I call the interdependence script and the independence script (Greenfield, 1994), are very basic and generative. Each model is a value framework that guides development, socialization, and behavior across many domains and in many cultures. Just as the model can explain cultural variability in Nabenchauk, it can explain cultural variability in Los Angeles. Here I focus on the sociocultural level of values.

Because change has been quite gradual in Nabenchauk and the Zinacantecs have kept changes pretty much under their own control in an intact community, this conflict between two models of socialization is relatively recent. The Zinacantecs are just beginning their journey on the path to individualism. However, the path is much more abrupt and disruptive for the many immigrants who come from rural Mexico to the United States. Although they have been much more integrated into the modern Mexican commercial economy, more touched by formal education, and less collectivistic than the Zinacantecs, they carry with them an ancestral value system that, relative to urban Los Angeles, is considerably more collectivistic. As research has shown, these immigrants, many from rural backgrounds, come to the United States with an interdependent script of socialization and development (Delgado-Gaitan, 1994; Greenfield, 1994; Tapia Uribe, LeVine, & LeVine, 1994). They meet a highly

commercial, individualistic society that has a developmental script based on independence and autonomy (Greenfield, Raeff, & Quiroz, 1998; Raeff, Greenfield, & Quiroz, 2000).

This culture conflict is expressed in many ways. For example, relative to the dominant culture, these immigrants experience parallel struggles to those of Rosy—between a model that stresses helpfulness and one that stresses doing it yourself. Here is an example:

> We arrived to start a study in an elementary school in West Los Angeles serving low-income Latino families. There had just been a major conflagration in the school involving the federally funded school breakfast program. The problem, as seen by the school, was that immigrant Latino mothers were accompanying their children to school, having breakfast with them, and helping their school age children to eat. When the school locked the families out of the schoolyard at breakfast, there was a major blow-up. (Quiroz & Greenfield, 1996)

One of the problems, as seen by the school personnel, was that these mothers were literally spoon-feeding their school-age kids instead of letting them eat by themselves. Such behavior was seen as leading to dependency rather than to the self-sufficiency advocated by the schools. On the other hand, helping the children eat their food also reflected Latino cultural values: being helpful toward one another is a highly desirable trait. Part of this conflict between the two value systems sets independence over and above helpfulness.

How general was this conflict over school breakfasts? Would it be correct to say that it reflected two contrasting cultural models of development? With Catherine Raeff and Blanca Quiroz, I conducted experimental research to investigate these questions (Raeff, Greenfield, & Quiroz, 2000). We administered a set of scenarios concerning social dilemmas at home and at school in two different schools. Each dilemma could be solved in a number of different ways, some consonant with an individualistic model of development and socialization, some consonant with a collectivistic model. Parents, teachers, and children were tested in two schools. Here I focus on one school in which the families were Latino immigrants. I have selected a sample dilemma that relates to the school breakfast issue; in this dilemma, which takes place at school, the issue is whether to help or not:

> It is the end of the school day, and the class is cleaning up. Denise isn't feeling well, and she asks Jasmine to help her with her job for the day which is cleaning the blackboard. Jasmine isn't sure that she will have time to do both jobs. What do you think the teacher should do? (Raeff, Greenfield, & Quiroz, 2000)

Figure 10.20 shows the results. Just as the school was unified in the opinion that mothers should not help their school-age children to eat, the majority of teachers (Fig. 10.20) were in agreement that Jasmine should not have to help Denise. Most frequently they thought a third person should be found to do the job (see Fig. 10.20). The point, often, was to get someone who would volunteer, that is, do the job by choice. They did not want to infringe on Jasmine's autonomy in achieving completion of her own job. Latino immigrant parents, in sharp contrast, were quite unified in their view that Jasmine should help Denise (Fig. 10.20). This response paralleled their desire to help their children eat breakfast.

This pattern of results shows a strong conflict between helpfulness and independent autonomy, with Latino parents supporting helpfulness and teachers (representing dominant societal culture) going for preserving Denise's autonomy. The Latino children (like Rosy) are often in between, constructing their own values out of two disparate and conflicting value systems. Here, for example, they are in between parents and teachers on helpfulness (Fig. 10.20).
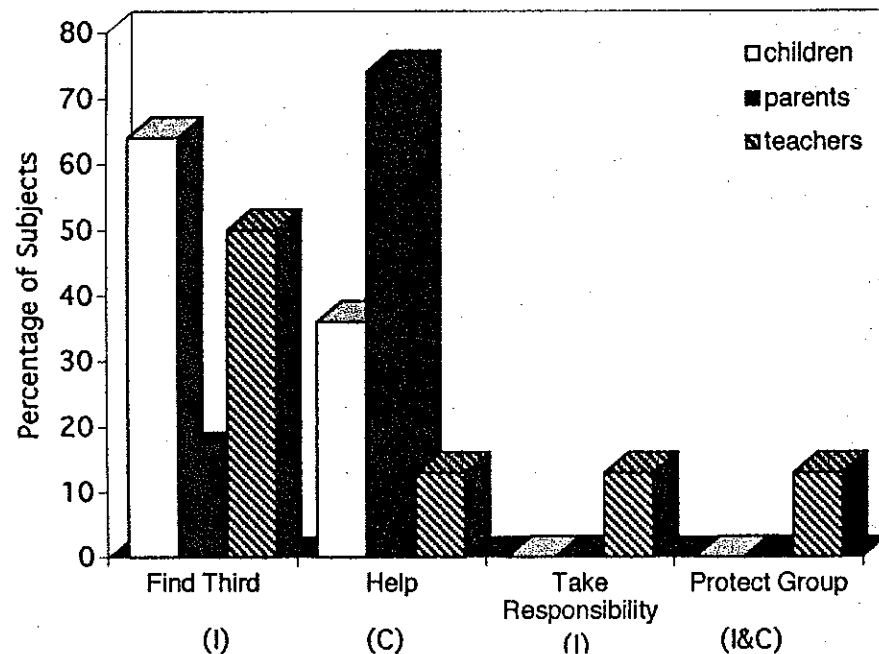

FIG. 10.20. Distribution of responses to the "jobs" scenario by Latino immigrant parents, their children, and teachers. Figure courtesy of Catherine Raeff.

As we saw for the Zinacantecs, another aspect of the collectivistic world view is an ethnotheory of development in which cognitive skills are in the service of social goals. In the Latino immigrant ethnotheory, cognitive development is subordinated to social relations—just as it is for the Zinacantecs. This can lead to other kinds of cross-cultural value conflicts and misunderstandings in the individualistic schools. Here is an example:

> During one of our observations of a Los Angeles prekindergarten class made up of mostly Hispanic children, the teacher was showing a real chicken egg that would soon hatch. While teaching the physical properties of the egg, she asked children to describe eggs by thinking about the times they had cooked and eaten them. One child tried three times to talk about how she cooked eggs with her grandmother, but the teacher disregarded these comments in favor of a child who explained that the insides of eggs are white and yellow. (Greenfield, Raeff, & Quiroz, 1996, p. 44)

From the Latino point of view, the first child's answer was typical of the associations encouraged in her home culture of interdependence. That is, objects are most meaningful when they mediate social interactions. The child therefore acted on this value of interpersonal relations in answering the teacher's question. The teacher, however, did not recognize this effort on the part of the child and considered the social descriptions of the time they had eaten eggs as irrelevant; only physical descriptions of these occasions seemed to be valued (Greenfield, Raeff, & Quiroz, 1996). Here, the ethnotheory of development that places knowledge of the physical world as a means to social relationships is not valued or understood. Cognitive development expressed in relation to a social context is devalued.

CONCLUSION

I have tried to present a model that features a new idea: age-dependent sensitive periods for cultural learning. Because of the actualization of these biologically grounded developmental windows by the sociocultural component, the implication is that the same cognitive stage will take different forms in different cultures. Just as we would not expect concrete operational children in the United States to set up a backstrap loom, we might not expect concrete operational children in Nabenchauk to solve a problem in cross-classification (and in fact in an experiment I tried, concrete operational children could not do this; Greenfield, 1973).

My theoretical model also explains development as an interaction among various levels: the maturational, the sociocultural, the ecological, and the historical. Thus, biological concepts are integrated with sociocultural ones. I have tried to illustrate the complex interactions among

the various levels by using findings from a relatively simple, homogeneous society, a Maya community in Chiapas, Mexico. I have selected a part of the model, the level of symbolic value interpretations, to test in Los Angeles, where we have found the same opposition between two different ethnotheories or models of development, a more collectivistic model stressing helpfulness and a more individualistic one stressing autonomy.

Integrating Theories of Social and Cognitive Development

In the West, there is a split between theories of social and cognitive development. This reflects a split in Western goals for development and a split in Western ethnotheories of development. In many cultures, such a split between the cognitive and the social is not the norm; cognitive skills are seen as a means to social goals. I propose that our formal theories are only as universal as the ethnotheories they presuppose. Therefore, we need a formal theory of development that does not presuppose the dominance of cognitive development nor the split between the social and the cognitive. In conclusion, we need a universal theory that transcends culture-specific ethnotheories of development. This requires a higher order theory that integrates different ethnotheories as alternative paths in a more universal theory of development.

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