Through the longitudinal study of families over two decades in Chiapas, Mexico, this chapter relates historical changes on the macro level to changes in human development and socialization on the micro level.

Cultural Change and Human Development

Patricia M. Greenfield

Cross-cultural studies of cognitive development preceded studies of cultural learning. The former studies made an implicit assumption that *culture is external whereas development is internal.* Bruner's cultural psychology (1990) and Tomasello, Kruger, and Ratner's cultural learning (1993) assume, by contrast, that culture is *inside* the individual, that human beings are intrinsically social and primed both to learn from and to teach their conspecifics. With this new assumption, the old dichotomy between biology as nature and culture as nurture breaks down. Culture becomes part of human nature. Most important for present purposes, the conception of culture as internal rather than external privileges the study of developmental processes of cultural appropriation, to use a term originated by Saxe (1991). But studies of intergenerational cultural apprenticeship (Rogoff, 1990)

An earlier version of this chapter was presented at Development, Evolution, and Culture, an invited symposium organized by Elliot Turiel at the twenty-fifth annual symposium of the Jean Piaget Society, Berkeley, Calif., June 1, 1995, and at the Growing Mind, Geneva, Sept. 1996. Thanks to Emily Yut and the Thursday lab group for discussion and feedback on a previous version of this chapter. Special appreciation to Leslie Devereaux for help in the field and help in understanding Zinacantec culture and people. Thanks to Ashley Maynard for help with the video illustrations and the manuscript. Deep gratitude to Carla Childs and the late Shun Pavlu for being part of it all.

The research on which this paper is based was supported by the Spencer Foundation, the National Geographic Society, the UCLA Latin American Center, the UCLA Center for the Study of Women, the National Institutes of Health Fogarty International Center, the Minority International Research Training Program to UCLA—El Colegio de la Frontera Sur (TW00061), El Colegio de la Frontera Sur, the UCLA Academic Senate, the Harvard Center for Cognitive Studies, the Bunting Institute of Radcliffe College, and the Milton Fund of Harvard Medical School.

must not merely elucidate the learning processes by which cultural skills are *transmitted* from an older to a younger generation. They must also elucidate the learning processes by which cultural skills are *transformed* from one generation to the next. This is the psychological issue of cultural change, raised by Wolfgang Edelstein in Chapter One and Geoffrey Saxe in Chapter Two of this volume.

Cross-Cultural Comparison: Indirect Methods for Studying Cultural Change and Human Development

The earliest methods for addressing cultural change from a psychological perspective were *cross-cultural* comparative studies of cognitive skills, at first based on the crude and simplistic notion of a ladder of cultural evolution. Later studies used methodologically tighter *within-culture* comparative methods to assess the impact of locally observed cultural changes on cognitive processes and cognitive development: Saxe's study of the impact of commercial development on Oksapmin number concepts in New Guinea (1982), Vygotsky and Luria's study of the effect of collectivization on logical operations in the Soviet Union (Luria, 1976), and my study of the effect of schooling on the development of categorization and conservation in Senegal (Greenfield, 1966; Greenfield, Reich, and Olver, 1966) are examples of cross-sectional studies that make inferences concerning the effects of longitudinal sociocultural change.

However, cross-sectional studies can produce only *indirect* evidence concerning cultural change. This is because one must assume that the diachronic or longitudinal effect of the variable under study is the same as the synchronic or cross-sectional effect: for example, that Luria's collectivized peasants in Uzbekistan *used to* think like their uncollectivized neighbors before collectivization took place.

However, when researchers address historical change by comparing two contemporaneous human groups, it is always a possibility that *both* groups being compared have changed during the historical process under study. In Luria's study, for example, both uncollectivized and collectivized peasants may have changed during the postrevolutionary period of collectivization. Even more problematic, there is always a possibility of differential selection bias in the two groups being compared: for example, collectivized and uncollectivized peasants may well have been different before collectivization took place. Consequently there is a need for direct, longitudinal study of historical change.

Cross-Generational Comparison: A Direct Method for Studying Cultural Change and Human Development

I would now like to describe a unique research design that is both historical and longitudinal: it compares socialization and development in two successive generations of the same group of families. The study of the second generation was begun two decades after the study of the first generation had been com-

pleted. This research project explores the relations between sociohistorical transformations and human development in a direct way, by following a group of families over two generations—studying their learning and representational processes before and after processes of important ecological change. More specifically, we have investigated the historical transition from agriculture to commerce, focusing on its developmental and learning implications. The study site is a community in transition from agricultural subsistence to commercial entrepreneurship and cash.

Our study examines the relationship between intergenerational continuity and intergenerational change on the cultural level and processes of learning, innovation, and cognitive development on the individual level. In so doing, we elucidate the role of both social interaction and external representational tools in these processes of cultural continuity and change.

Theoretical Framework and Questions

My major theoretical proposition is that as cultures change over historical time, the very processes of cultural learning and cultural transmission also change. More specifically, a somewhat different set of learning processes are highlighted when cultures are in a more stable state, compared with when they are in a more dynamic state. A second theoretical proposition is that even in periods of cultural change, some learning processes of the individual and some cultural foundations of the group remain constant. A third theoretical proposition is that cultural change on the economic level leads to changes in representational strategies on the cognitive level (compare Saxe, 1982).

Insofar as the process of socialization prepares the next generation to participate in society, the process and its outcomes should change when the conditions faced by that next generation differ from the environment in which their parents grew up. Socialization is intrinsically future-oriented: it prepares children for an adulthood that still lies in the future. However, a key question is, in conditions of change, do parents merely recreate the apprenticeship process that they underwent as children? Or do parents have the capacity to develop new methods and processes of apprenticeship as societal conditions—in this case, economic conditions—change? And what, if any, are the consequences of such changes for the development of their children?

At the same time, as the cultural historical school emphasizes (for example, Scribner, 1985), there is an accumulation of cultural history; there is always continuity as well as change. This continuity provides a foundation that persists and affects processes of learning and representation through the course of sociohistorical change.

In human history, there have been three major ecological adaptations: hunting and gathering, agriculture, and commerce, which includes emphasis on advanced technology. It is hypothesized that each ecology emphasizes a different set of skills, different developmental pathways, and different processes of socialization or cultural transmission.

The First Generation

In 1969 and 1970, in collaboration with Carla Childs, I carried out a number of studies of culture, learning, and cognitive development in Nabenchauk, a hamlet of the agrarian Maya community of Zinacantan (summarized in Greenfield, Brazelton, and Childs, 1989, and Greenfield and Childs, 1991). Zinacantan is a Tzotzil-speaking community, located in the highlands of Chiapas, Mexico (Vogt, [1970] 1990). All communication between researchers and subjects occurred in Tzotzil.

Our focus was on the cognitive skills and learning processes involved in the important cultural technology of weaving, the most complex skill in the culture, a skill acquired by all Zinacantec women (Childs and Greenfield, 1980; Greenfield, 1984; Greenfield and Childs, 1977). Weaving was our focus for studying processes of informal education, learning, and cognition in a society in which education does not traditionally take place in school (Greenfield and Lave, 1982). Weaving is considered to be the essence of Zinacantec womanhood. Figure 3.1 shows a girl seated at the ancient Maya backstrap loom.

Schooling was not entirely absent from the community, although it was an outside force, carried out in a foreign language, Spanish, and delivered by teachers who were Ladinos, a local term for people who identify with national Mexican culture and are often racially mixed (mestizo) between indigenous Maya and Spanish. There were two elementary schools in the village, attended almost exclusively by boys. No one in the community had an education

Figure 3.1. Katal Pavlu Seated at a Backstrap Loom, 1970

Source: © Sheldon Greenfield.

beyond the elementary school level. Many who began school left before completing sixth grade.

Artifacts. Woven artifacts, like other parts of the culture, were stable and little changing, defined by tradition. The discipline of anthropology has called attention to the dangers of assuming stability in a culture up to the moment of the investigator's entrance. However, I had an opportunity to check empirically the hypothesis of relative stability in the traditions of woven patterns before my arrival in 1969. I was given access to a collection of ritual textiles created and used by the Vasquez family in Nabenchauk. This collection went from the 1940s into the 1980s; it confirmed the slow pace of change and, more important, the relative uniformity of textile designs up through 1969–1970, the point at which we studied the first generation.

In that period, woven patterns were limited to two red-and-white striped configurations, one multicolor stripe, and one gray-and-white basketweave pattern. Figure 3.2 shows the two red-and-white striped patterns, with two variants of each pattern.

Cultural Learning. Based on our research in 1969 and 1970, we concluded that the goal of Zinacantec education and socialization was the intergenerational replication of tradition: learning to weave meant learning to weave a few very specific patterns. According to the findings from our videotaped observations, the particular way in which weaving was taught fostered this goal: the learning process was a relatively error-free one, in which the teacher, usually the mother, sensitively provided help, models for observation, and verbal direction in accord with the developmental level of the learner (Childs and Greenfield, 1980; Greenfield, 1984). Mother provided a scaffold of help that allowed the learner to complete a weaving she could not have done by herself. Figure 3.3 shows a mother helping her nine-year-old daughter, Katal, to weave. The image of four hands on the loom was a paradigmatic symbol for weaving apprenticeship in 1970.

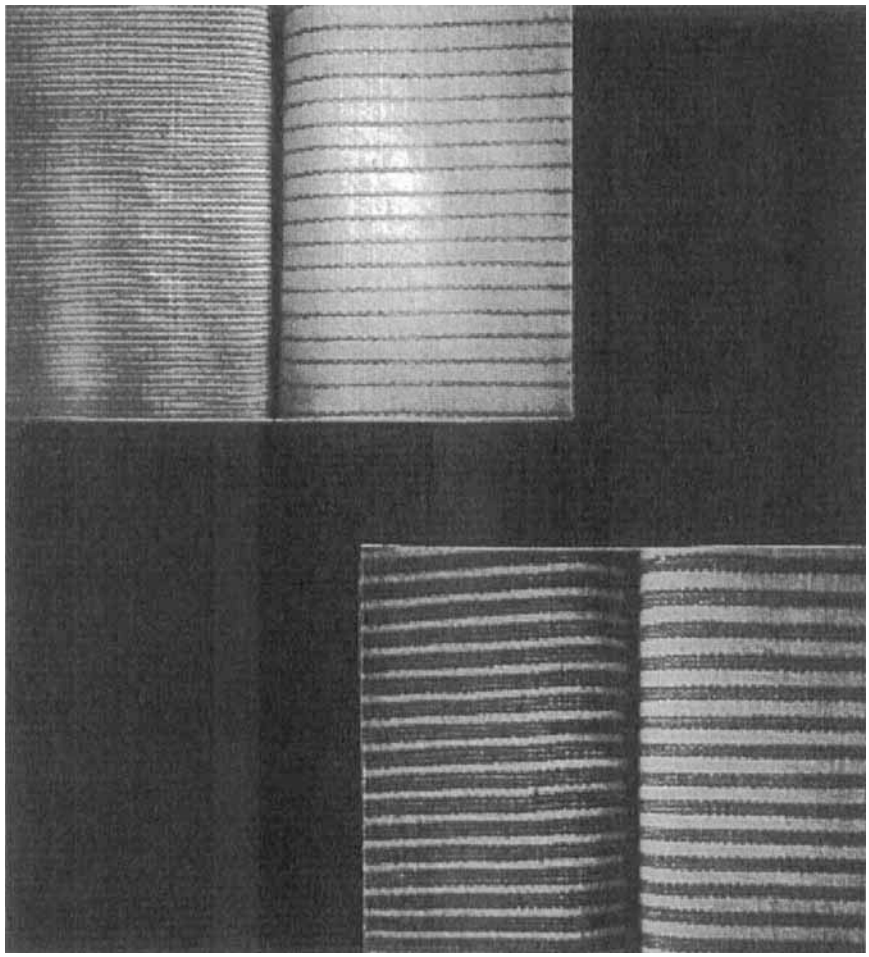
This scene is in sharp contrast to what occurred two decades later when Katal's daughter, also age nine, learned to weave in 1991.

Because the 1970 version of the apprenticeship process was highly structured by the older generation and did not allow room for learner experimentation and discovery, the method of informal education (or apprenticeship) was well adapted for the continuation of tradition, the maintenance of the status quo.

Cognitive Representation. In 1969 and 1970, we did a cognitive experiment (Greenfield and Childs, 1977). One of its goals was to assess the cognitive effects of weaving on pattern representation. Sticks placed in a frame were used to represent striped patterns (see Figure 3.4). Note that in addition to being various colors, the sticks came in three widths: thin, medium, and broad.

At the outset of the experiment, each subject was asked to create representations of two traditional Zinacantec woven patterns. These were the same patterns shown in Figure 3.2. The top pattern in Figure 3.2 was used for the male poncho, worn by the subject at the left side of Figure 3.4. The bottom pattern in Figure 3.2 is used for the female shawl, worn by the experimenter, Carla

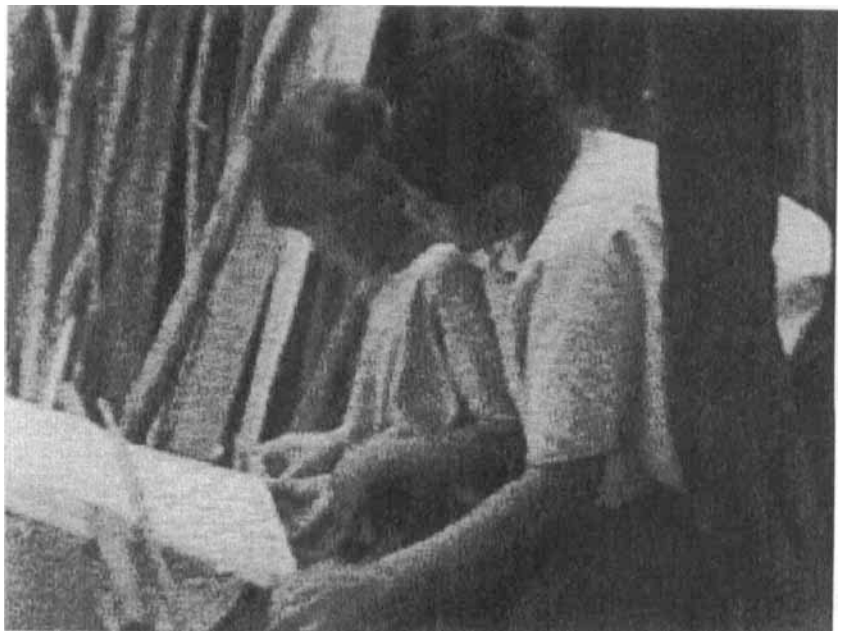
Figure 3.2. Two Red-and-White Striped Woven Patterns, 1969



Source: © Carla Childs.

The top pair are two variants of a pattern for a poncho worn by all boys and men. In all variants of the poncho pattern, the basic configuration of alternating thin red and thicker white stripes remains constant. The bottom pair are two variants of a pattern for a shawl worn by all girls and women. In all variants of the shawl pattern, the basic configuration of alternating a complex stripe (three thin reds separated by two thin whites) with a simple white stripe is maintained. Dark stripes represent red in the black-and-white photograph.

Figure 3.3. Xunica Kasya Helping Her Nine-Year-Old Daughter, Katal, with Her Weaving, 1970



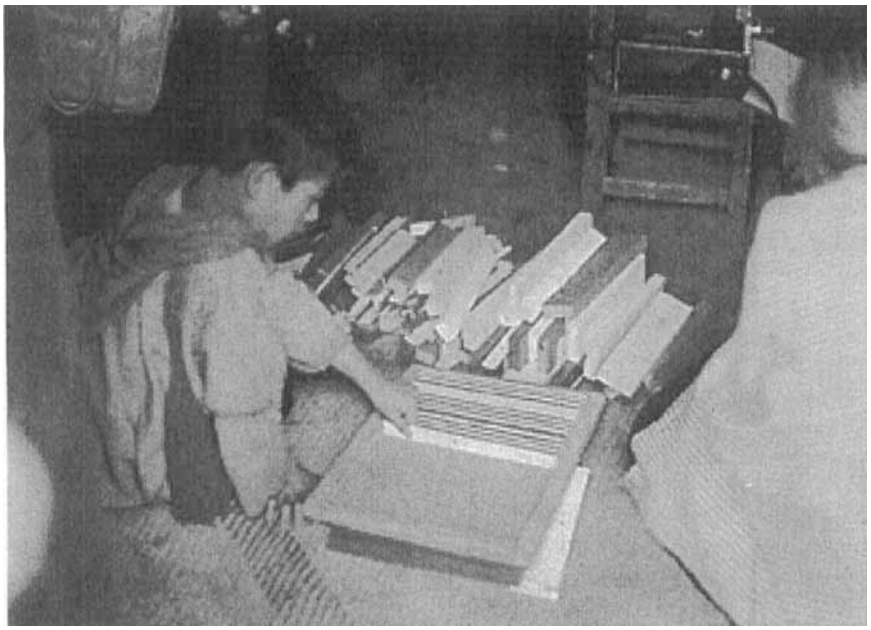
Source: Video still, 1970.

Childs, seated to the right in Figure 3.4. It is important to note that the poncho pattern (top of Figure 3.2) is a simple alternation of thin red and thicker white stripes, whereas the shawl pattern (bottom of Figure 3.2) has a complex red stripe consisting of three thin red stripes separated by two thin white ones; this complex red stripe alternates with a white stripe. Other patterns, starting with simple and familiar and progressing toward patterns of increasing complexity and novelty, were then modeled for the subjects to complete in the same frame.

The development of representational strategies moved from simple to complex with increasing age (Greenfield and Childs, 1977). By the time subjects reached teenage years, there was a differentiation of strategies for representing the woven patterns between schooled and unschooled subjects (all male) and between unschooled weavers (female) and nonweavers (male). Figure 3.5 shows a strategy of representation that was used more frequently by teenagers who either wove or had been to school; it was used less frequently by teenagers who had never been to school. We called the strategy depicted in Figure 3.5 a *detailed analytic* or *thread-by-thread analytic* representation. It accurately maintains the distinct configurations of the two striped patterns shown at the top and the bottom of Figure 3.2.

In contrast, unschooled teenage boys used more global, less analytic strategies for representing the woven patterns. Specifically, their strategies less

Figure 3.4. Pattern Representation Experiment



Note: The sticks come in three widths. The subject is seated to the left; the tester, Carla Childs, is to the right.
Source: © Sheldon Greenfield.

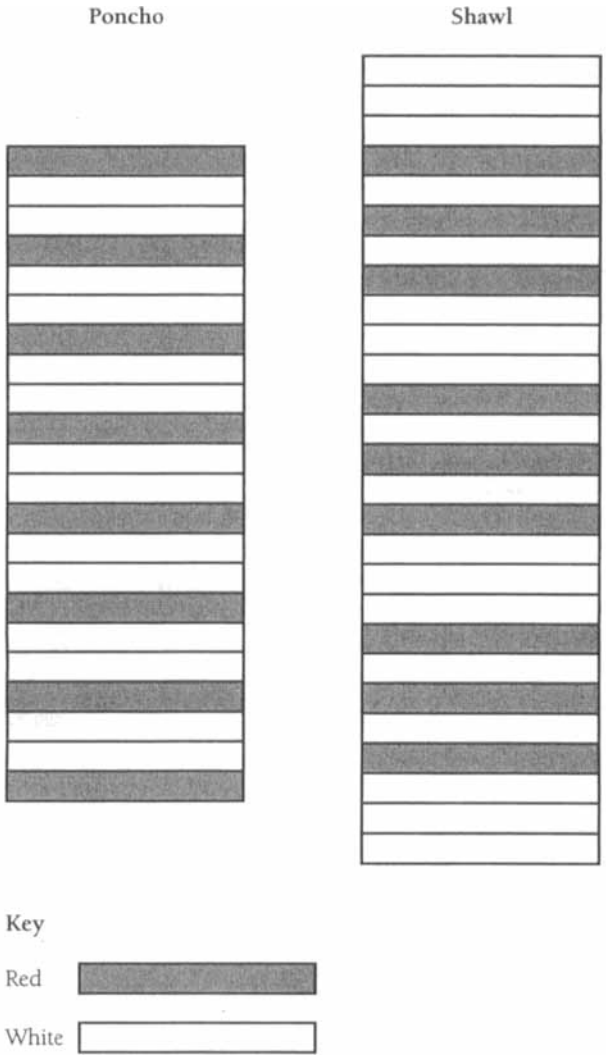
frequently indicated analysis of the complexity of the stripe in the shawl (narrow red, narrow white, narrow red, narrow white, narrow red, broad white; see bottom of Figure 3.2); some unschooled teenagers, for example, represented the shawl as a simple alternation of a broad red and a narrow white stripe.

At the same time, note, in Figure 3.5, that broad stripes are represented by grouping thin sticks together, just as, in a weaving, a broad stripe would consist of a series of threads grouped together. Clearly a weaver would know how a pattern was constructed, thread by thread. However, elementary level schooling clearly also pushed subjects in the direction of a more analytic approach to representing the patterns, including the thread-by-thread detail.

Figure 3.6 shows a technique of representation virtually never used by any Zinacantec subjects in our sample but frequently used by U.S. college students (Greenfield and Childs, 1977).

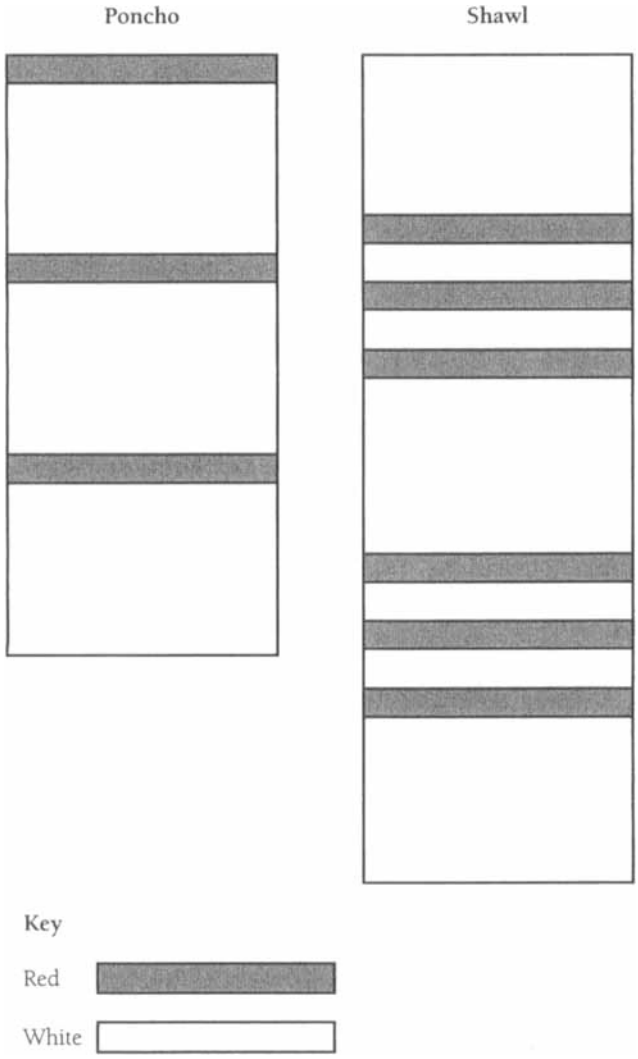
We called this the *abstract analytic* mode of representation. Like many of the skilled Zinacantec weavers and schooled Zinacantec teenage boys, most U.S. college students maintained the distinct configuration of each pattern, including analysis of the complex stripe in the shawl (right side of Figure 3.6). However, unlike the Zinacantec subjects, they used broad sticks to represent

Figure 3.5. Detailed Analytic Representation of the Two Red-and-White Striped Woven Patterns, 1969



Note: The pattern for the poncho worn by boys and men is shown at the left; it is a representation of the pattern shown at the top of Figure 3.2. The pattern for the shawl worn by girls and women is shown at the right; it is a representation of the pattern shown at the bottom of Figure 3.2.

Figure 3.6. Abstract Analytic Representation of the Two Red-and-White Striped Woven Patterns



Note: The pattern for the poncho worn by boys and men is represented at the left; it is a representation of the pattern shown at the top of Figure 3.2. The pattern for the shawl worn by girls and women is represented at the right; it is a representation of the pattern shown at the bottom of Figure 3.2.

broad stripes (poncho and shawl representations in Figure 3.6). This strategy is abstract in that the representation of the broad stripe eliminates the detail of the thread-by-thread strategy.

Whereas both weaving and elementary level schooling were associated with the detailed analytic strategy, advanced education or other distinctive features of U.S. culture were associated with the abstract mode of analysis. One possible causal factor in the prevalence of the abstract mode of representation is the importance of money, as an abstract medium of exchange, in the U.S. economy. The abstraction of money contrasts with the specificity of barter exchanges, common in subsistence cultures like Zinacantan. This question of causal factors for the abstract analytic mode of pattern representation was pursued through the historical replication of the experiment two decades later; its results will be discussed in the last section of this chapter.

Symbolic Tools. These we define as tools for creating external representations. This was not an area of study in 1969 and 1970 because there were virtually no tools for creating external representations in the community. The only exception was the winding board that could be used to create a striped warp for the striped or basketweave textiles that could be copied by other weavers. Although there were statues of saints in the churches, these were brought in from outside the community, so no representational tools for creating them existed. One did not see paper and pencil in homes. Nor did one see figurative drawing. The area of symbolic tools came to our attention in the follow-up study two decades later because the situation in this arena had changed so drastically.

Ecological Change: The Next Generation

Seventeen years after we completed our original field research in Zinacantan, I heard about a major social and economic change (Cancian, 1987, 1990, 1992). Men who formerly farmed now were in the transport business. They had become commercial entrepreneurs, running a van service back and forth to the neighboring Mexican city of San Cristobal de las Casas. Others had entered the trucking business as both drivers and owners.

We investigated the implications of this ecological and economic transformation for change in each of the four areas introduced earlier:

1. Change in artifacts and the skills that produce them
2. Changes in processes of cultural learning and cultural transmission
3. Changes in modes of cognitive representation
4. Changes in symbolic tools

In 1991, I returned to the community with my original collaborator, Carla Childs; Leslie Devereaux, an anthropologist with years of experience in the community, and my daughter, Lauren Greenfield, a photographer with

an assignment from the National Geographic Society, also accompanied us. Our research goal was to investigate the changes by replicating our studies with the next generation, now roughly the same age as their parents, aunts, and uncles had been when they served as subjects in the 1969 and 1970 studies.

We made certain predictions about the nature of changes that we thought we would find. Each prediction was made strictly on theoretical grounds (for example, Greenfield and Lave, 1982). Neither Carla Childs nor I had been back to the community to observe what was going on since 1970.

As we explored change, we also noted the foundation of constancy provided by the accumulation of history in each of the four areas. Each of these areas—artifacts, modes of cultural learning, development of modes of representation, and symbolic tools—will now be taken up and elaborated, one at a time.

Artifacts. Because entrepreneurship entails an ideology of innovation, I predicted that innovation would enter the culture in a general way, affecting many areas of life. One such area was textile and clothing production. Therefore, I predicted that woven textiles would no longer be limited to a small stock of patterns; instead, weavers would constantly innovate new patterns. This was conceptualized as a major shift in representational processes and therefore as a shift in cognitive development. The new array of patterns would also constitute a shift in the stock of cultural artifacts.

The results were quite astonishing. A tremendous amount of innovation was taking place in woven patterns. Some of the innovation was connected to the spread of commercialization to weaving production: new items had been developed to sell to tourists. But the innovation in the clothing Zinacantecs wove for themselves was even greater. The contrast with the single pattern for each article of clothing found in the earlier period was great. Figure 3.7 shows two brothers dressed in identical ponchos. Indeed, all males wore the same poncho in 1969 and 1970.

By 1991, each poncho was different. Two examples are shown in Figures 3.8a and 3.8b.

These examples include innovation in both the weaving (the brocaded bands at the bottom of each poncho) and the embroidery (the vertically arranged designs above the bottom border, shown more completely in Figure 3.8a).

Similar changes had occurred in girls' and women's blouses. Figure 3.9 shows the standard blouse in 1969 and 1970.

Figures 3.10a and 3.10b show two variants of a potentially infinite number of different embroidered patterns.

As these examples suggest, our prediction was confirmed: Zinacantecs of the 1990s were engaging in a constant process of pattern creation. No two pieces of clothing or other woven items were exactly alike. The results were the same in the domain of embroidery. We saw both new motifs and new recombinations of old motifs. Geometric designs (as in Figure 3.10a) had greatly expanded, and figurative representations (as in Figure 3.10b) had arrived; there had been no figurative representation in Zinacantan two decades earlier.

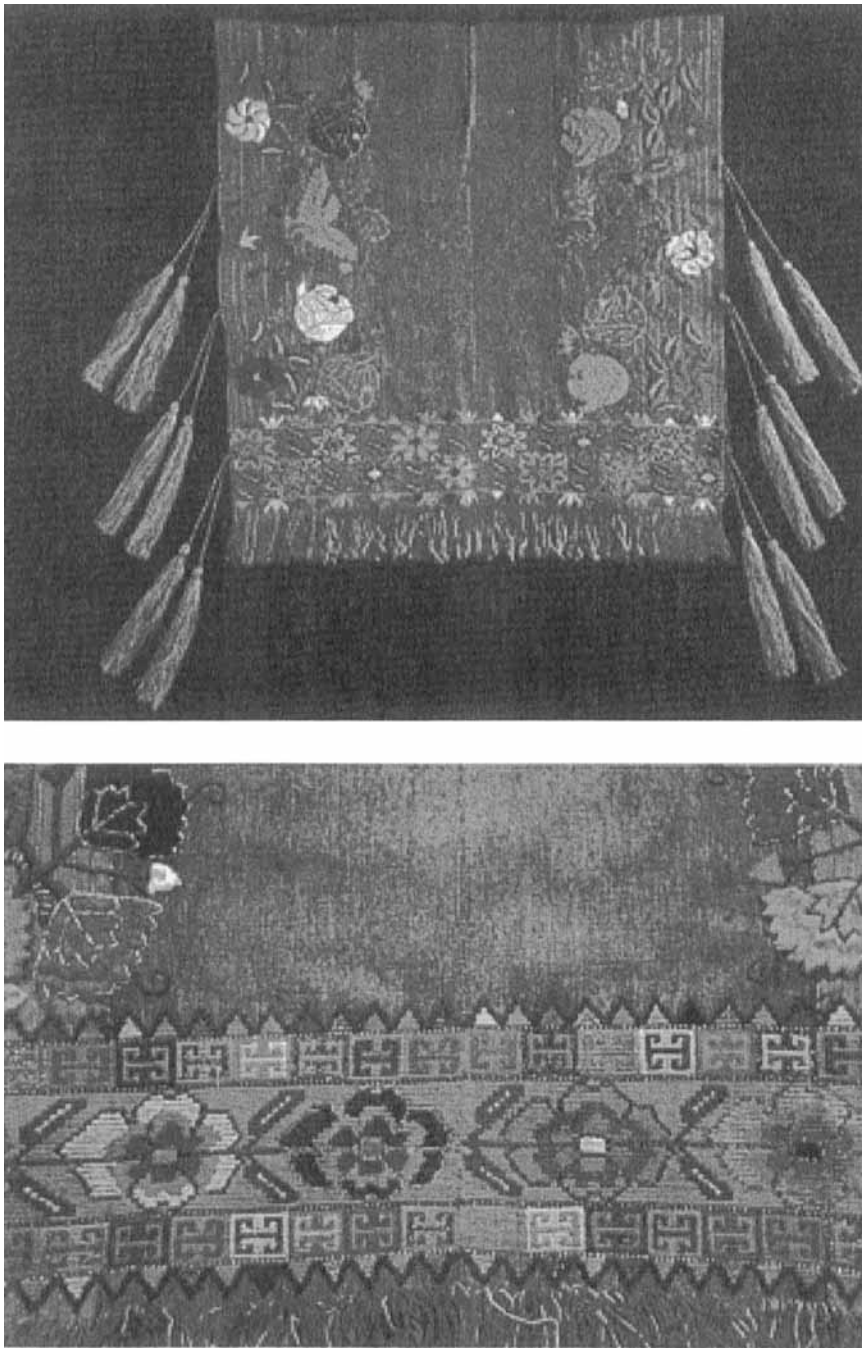
Figure 3.7. Two Zinacantec Brothers, Marian and Antun Pavlu, Dressed in Ponchos Using the Woven Stripe Shown in Figure 3.2, Standard in 1969 and 1970

Source: © Sheldon Greenfield.

Note, however, that there is cultural constancy in change: for example, the style and background stripe of the men's poncho remained the same. The simple red-and-white stripe shown at the top of Figure 3.2 was still the background pattern for the ponchos shown in Figures 3.8a and 3.8b, even though the stripe now had more red than white. The cut of the old blouse in Figure 3.9 had not changed in the new blouses (Figures 3.10a and 3.10b). Similarly, the positioning of the embroidery around the neck and running down from each shoulder had stayed the same; the embroidery had simply become much more elaborate and variable.

Modes of Cultural Learning. Based mainly on our earlier research and on observing a backstrap weaving class in Cambridge, Massachusetts, I had

Figures 3.8a and 3.8b. Variants of the Poncho Worn by Boys and Men, 1991



Source: © Lauren Greenfield.

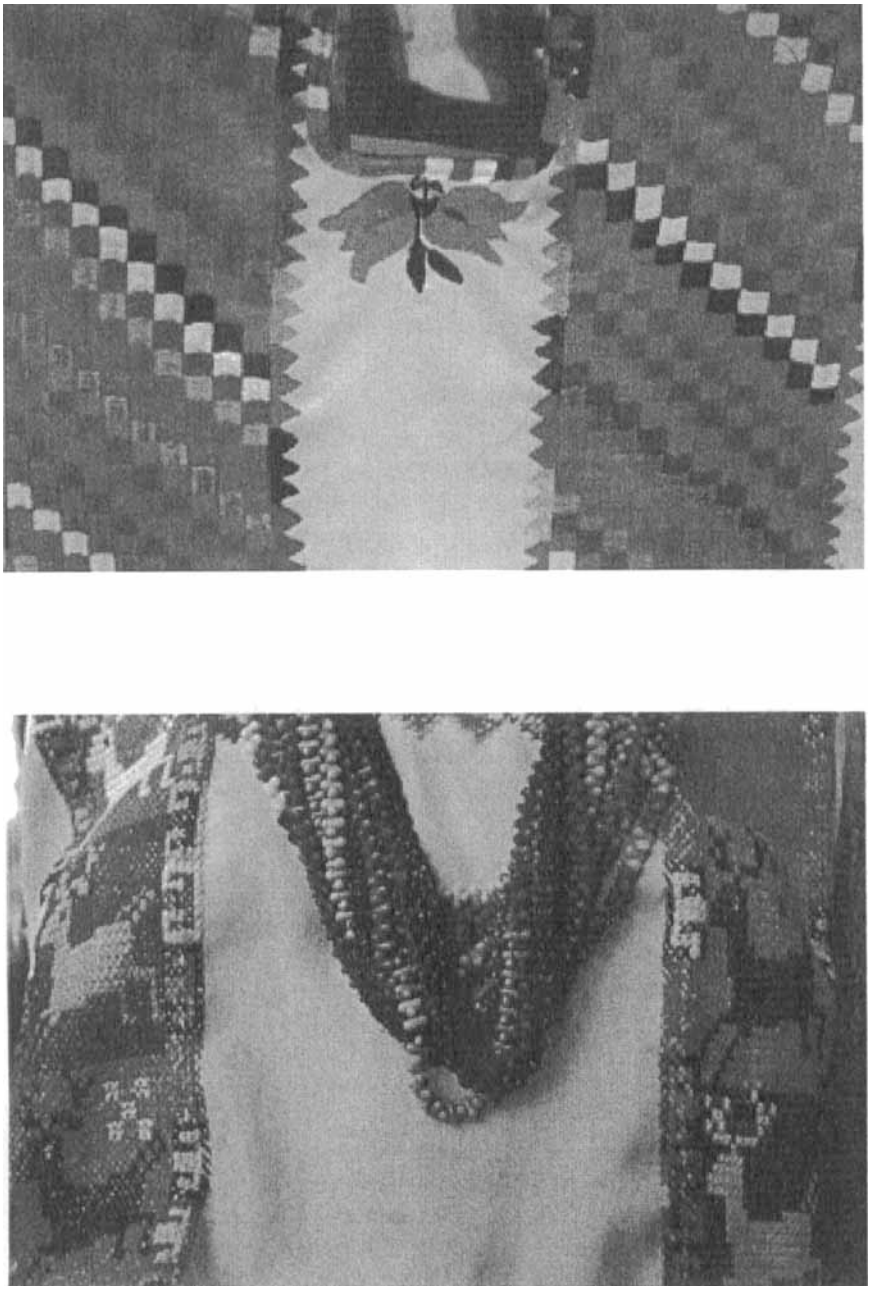
Figure 3.9. Example of Zinacantec Blouse, Worn by Katal Pavlu, That Was Standard in 1969 and 1970

Source: © Sheldon Greenfield.

developed a theory centering on a contrast between the goals of two methods of informal education: scaffolding with observational models (which was typical in 1970 and which was illustrated in Figure 3.3) and relatively independent trial-and-error or discovery learning (Greenfield and Lave, 1982). In a sense, as Gelman (personal communication, 1991) has pointed out, we predicted a historical shift from a Vygotskian model of learning (emphasizing scaffolded guidance) to a Piagetian model (emphasizing independent discovery).

Whereas the first model, according to my theory, is adapted to transmitting a tradition intact, the second, with its emphasis on the learner's own discovery process, is adapted to the development of an ability to innovate. If innovation had in fact entered the culture as a value orientation in response to or as part of commercial entrepreneurship, I thought that weaving education would make a corresponding shift. Earlier the teacher had carefully built a scaffold of help for the learner, providing help before the learner had an opportunity to make a serious error. Because the learner, in this situation, received very

Figure 3.10a and 3.10b Variants of the Zinacantec Blouse, 1991



Source: © Lauren Greenfield.

little opportunity to make a mistake, let alone to explore, I predicted that as the economy became more entrepreneurial, the methods of teaching and learning would change to a more independent trial-and-error approach, an approach that allows room for discovery.

Did the predicted change occur? A well-controlled historical comparison provides important information. The girl learning to weave in Figure 3.3 grew up and had five daughters of her own. In 1991, one of the daughters, Loxa, was the same age (nine) that her mother, Katal Pavlu, had been when we videotaped her learning to weave twenty-one years earlier.

The nature of Loxa's apprenticeship in 1991 was completely different from that of her mother in 1970. First of all, the generation of the teacher had changed. Instead of teaching her daughter herself, as her mother had done for her (Figure 3.3), Katal assigned her twelve- or thirteen-year-old daughter, Xunka, to serve as Loxa's teacher (Figure 3.11).

Second, in contrast to the way in which her mother anticipated her daughter's need for help, Xunka paid little attention to her younger sister as she sat working at the loom. Note, in Figure 3.11, that Xunka's visual attention is not on her younger sister, seated at the loom. Indeed, in one segment of the videotaped weaving session, Loxa (the learner) had to call her sister twice to get her attention and ask for help. The help is forthcoming; the difference from a generation earlier is that it is learner- rather than teacher-initiated.

Figure 3.11. Weaving Learner Loxa Santis, Age Nine, and Her Teacher, Her Older Sister Xunka

Source: Video still, 1991.

A comparison of Figure 3.3 and Figure 3.11 shows another related difference: the 1991 teacher in Figure 3.11 is much more distant from the learner than is the 1970 teacher in Figure 3.3. Third, Katal reported that her daughters had started to weave on their own initiative, whereas she had begun in response to the directive of her mother. All of these differences are indices of a historical shift from a more interdependent to a more independent learning process (see Greenfield, 1994).

In summary, changes in the material culture of woven and embroidered artifacts to an innovative mode entailed change in the method by which weaving was taught and learned. The mode of cultural learning changed from a closely guided one, adapted to maintaining an unchanging stock of traditional artifacts, to a more independent one, adapted to creating cultural innovation and novelty. Quantitative analysis indicated that this historical change in methods of apprenticeship was a general one, not limited to the particular historical case study presented here (Greenfield, Maynard, and Childs, 1997).

Through the changes, there were also some constants in this process. Just as the woven artifacts themselves mixed tradition and innovation, many parts of the acquisition process had constant as well as novel elements. One constant element was a preweaving stage of play weaving on a toy loom (Figure 3.12).

Figure 3.12. Loxa Pavlu, Age Five, Creating a Play Weaving at Her Toy Loom, 1991

Source: © Lauren Greenfield.

This was an experience reported by virtually all learners and their mothers. The toy loom (see Figure 3.12) is a culturally standardized tool that, because of its slightly different design from the real loom, is easier to set up (Greenfield, forthcoming). Its constancy over time illustrates how cultural history builds on the past, even as it transforms it.

Thus far we have confirmed our first prediction concerning the historical transformation of cultural artifacts and our second prediction concerning the historical transformation of cultural learning. Our third prediction concerns the historical transformation of cognitive processes.

Development of Modes of Representation. Because of the growth of the cash economy, with its abstract medium of monetary exchange, we anticipated that our experimental study of pattern representation would show historical growth in the use of abstract representational strategies as the Zinacantec ecology moved from agriculture to commerce.

Indeed, this is what we found. The abstract analytic way of representing the woven patterns, shown in Figure 3.6, had appeared for the first time in Nabenchauk. In general, abstraction (using thick sticks to represent broad stripes) had significantly increased between 1969–1970 and 1991.

The detailed analytic approach had not disappeared. However, the distribution of representational styles had changed to include the abstract analytic approach. In general, the balance between detailed and abstract representation of the woven patterns had shifted to a lower frequency of detailed (that is, thread-by-thread) representations of the woven stripes. Against a background of historical constancy, the economic transition from agriculture to commerce brought with it a more abstract approach to representing cultural artifacts.

In the final section, I move from the representation of cultural artifacts to the nature of cultural tools.

Symbolic Tools. The final aspect of the results was unpredicted. It relates to the development of new symbolic tools. Although the backstrap loom, of ancient Maya origin, has remained the same, there have been some new symbolic tools that relate specifically to the creation of varied designs. I term these tools *meta-representational* because they are tools for creating patterns, that is, for creating representations. No meta-representational tools had existed in the earlier period.

The most interesting and most complex of these new meta-representational tools is the use of paper patterns for weaving. Figure 3.13 shows a pattern being used for brocade weaving in 1991. The pattern book is not of Zinacantec origin; it was printed in Mexico City.

What is particularly interesting are the representational conventions that were developed for using such patterns for weaving. Because these printed patterns were developed for cross-stitch embroidery, the pattern is printed on a grid of squares; each square represents one cross-stitch on a piece of embroidered fabric.

However, unlike embroidery, weaving is not naturally organized in squares. There are parallel warp (or frame) threads, shown in white in Figure 3.13; and there are parallel weft threads that go over and under the warp threads, at right

Figure 3.13. Pattern Book (Printed in Mexico City) Being Used for Brocade Weaving, 1991

Source: © Lauren Greenfield.

angles to them. (In the figure, the weft are the dark threads in the woven part of the warp, to the left of the unwoven white warp threads.)

Therefore, it was necessary to develop a representational strategy for creating hypothetical squares in order to use the printed patterns for weaving. And this is exactly what Zinacantec weavers did. One weaver told me that one square would correspond to one thread in the warp dimension (white threads) and to four threads in the weft dimension (the darker, crosswise threads). This is a fairly complex representational code to create, especially with just a few years of formal education. Zinacantec girls have appropriated a new symbolic tool, the printed pattern, and transformed it, as part of the process of cultural appropriation (see Chapter Two in this volume).

However, most of the older generation of mothers do not know how to weave with paper patterns; for them, the absence of formal schooling is a barrier to understanding the code of symbolic correspondences (Greenfield and Maynard, 1997). Because of the much higher rate of using paper patterns in the younger generation, we see that innovative cognitive change is concentrated in the younger generation, a phenomenon that is very familiar in our own society.

Historical continuity is manifested in the fact that Zinacantec females, especially members of the younger generation, still use other people's textiles and clothing as tools for creating patterns. The textiles of others are used as

models both for the traditional background designs (for example, red and white stripes) and for the newer figurative or geometric designs.

Conclusions

The direct, controlled study of cultural historical change has reaped rich rewards in creating theoretical and empirical links between individual processes of cultural apprenticeship and societal processes of cultural change. It points to a process of reciprocal change in which societal conditions provide an ecological push toward new modes of cultural apprenticeship, as new modes of apprenticeship create a younger generation with the skill profile appropriate to the changed societal conditions. Zinacantec mothers are not bound by the way they were taught weaving as young girls two decades earlier. Instead, they seem to follow the rule put forth by Pérusse, Neale, Heath, and Eaves (1994): teach what is adaptive in the present context.

Our findings confirm my major theoretical proposition that as cultures change over time, the very processes of cultural learning and cultural transmission also change. More specifically, our findings indicate that processes of scaffolded guidance (the processes emphasized by Vygotsky) are highlighted when cultures are in a more stable, tradition-maintaining state. In contrast, processes of independent, trial-and-error experimentation (the processes emphasized by Piaget, [1965] 1977) are highlighted when cultures are in a more dynamic, innovation-oriented state. As the Zinacantecs moved from one state to the other in the space of two decades, the emphasis in their modes of cultural learning changed accordingly.

At the same time, we found continuity in an early stage of weaving apprenticeship, play weaving on the toy loom. This continuity was part of a larger historical continuity in weaving technology, textiles, representational skill, and subsistence lifestyle of the Zinacantecs. Yet points of continuity can become cognitively transformed in the process of cultural change: for example, the historical continuity in the background woven patterns of the men's poncho and women's shawl contrasted with new, more abstract ways of representing these patterns, hypothesized to be a reflection of the intrinsic abstraction of money as a medium of exchange. Historical continuity in the background woven patterns also contrasted with the novelty of the woven and embroidered designs superimposed on this background.

Finally, we observed the appearance of Zinacantan's first meta-representational tools. In this chapter, I have used the example of printed patterns, which function as tools for creating representations. These have been appropriated by the younger, more school-educated generation to support the creation of varied woven and embroidered designs. At the same time, such tools provide external symbolic supports for maintaining and expanding processes of cultural apprenticeship.

In sum, we have observed coordinated changes on the levels of economics, learning modes, artifacts, and cognition. Sociocultural forces on the macro level affected the process of cultural apprenticeship on the micro level. Changes in processes of cultural apprenticeship produced a new generation that was well adapted to the changed ecological niche. In other words, there was a tight relationship between a changing ecological niche and a changing developmental niche (Super and Harkness, 1986).

To end on a speculative note and address one of the themes of this volume, I believe that the changes in cultural apprenticeship, cultural tools, and cognitive modes of representation observed in Nabenchauk are directional. They are directional because world societies are moving in the same direction as the Zinacantecs—toward ever-greater commercialization and commodification. I am much less sure that this direction constitutes progress in the human condition.

References

Bruner, J. "Culture and Human Development: A New Look." *Human Development*, 1990, *33*, 344–355.

Cancian, F. "Proletarianization in Zinacantàn." In M. D. Maclachlan (ed.), *Household Economies and Their Transformations.* Lanham, Md.: University Press of America, 1987.

Cancian, F. "The Zinacantàn Cargo Waiting Lists as a Reflection of Social, Political, and Economic Changes, 1952–1987." In L. Stephen and J. Dow (eds.), *Class, Politics, and Popular Religion in Mexico and Central America.* Washington, D.C.: American Anthropological Association, 1990.

Cancian, F. *The Decline of Community in Zinacantàn: Economy, Public Life, and Social Stratification, 1960–1987.* Stanford, Calif.: Stanford University Press, 1992.

Childs, C. P., and Greenfield, P. M. "Informal Modes of Learning and Teaching: The Case of Zinacanteco Weaving." In N. Warren (ed.), *Studies in Cross-Cultural Psychology*.London: Academic Press, 1980.

Greenfield, P. M. "On Culture and Conservation." In J. S. Bruner and others, *Studies in Cognitive Growth.* New York: Wiley, 1966.

Greenfield, P. M. "A Theory of the Teacher in the Learning Activities of Everyday Life." In B. Rogoff and J. Lave (eds.), *Everyday Cognition: Its Development in Social Context.* Cambridge, Mass.: Harvard University Press, 1984.

Greenfield, P. M. "Independence and Interdependence as Developmental Scripts: Implications for Theory, Research, and Practice." In P. M. Greenfield and R. R. Cocking (eds.), *Cross-Cultural Roots of Minority Child Development.* Mahwah, N.J.: Erlbaum, 1994.

Greenfield, P. M. "Culture and Universals: Integrating Social and Cognitive Development." In L. P. Nucci, G. B. Saxe, and E. Turiel (eds.), *Culture, Thought, and Development.* Mahwah, N.J.: Erlbaum, forthcoming.

Greenfield, P. M., Brazelton, T. B., and Childs, C. P. "From Birth to Maturity in Zinacantan: Ontogenesis in Cultural Context." In V. Bricker and G. Gossen (eds.), *Ethnographic Encounters in Southern Mesoamerica: Celebratory Essays in Honor of Evon Z. Vogt.* Albany: Institute of Mesoamerican Studies, State University of New York, 1989.

Greenfield, P. M., and Childs, C. P. "Weaving, Color Terms, and Pattern Representation: Cultural Influences and Cognitive Development Among the Zinacantecos of Southern Mexico."*Interamerican Journal of Psychology,* 1977, *11*, 23–48.

Greenfield, P. M., and Childs, C. P. "Developmental Continuity in Biocultural Context." In R. Cohen and A. W. Siegel (eds.), *Context and Development.* Mahwah, N.J.: Erlbaum, 1991.

Greenfield, P. M., and Lave, J. "Cognitive Aspects of Informal Education." In D. Wagner and H. Stevenson (eds.), *Cultural Perspectives on Child Development.* New York: Freeman, 1982.

Greenfield, P. M., and Maynard, A. E. "Women, Girls, Apprenticeship, and Schooling: A Longitudinal Study of Historical Change Among the Zinacantecan Maya." Presented at a symposium conducted at the 96th annual meeting of the American Anthropological Association, Washington, D.C., Nov. 1997.

Greenfield, P. M., Maynard, A. E., and Childs, C. P. "History, Culture, Learning, and Development." Presented at the biennial meeting of the Society for Research in Child Development, Apr. 1997.

Greenfield, P. M., Reich, L. C., and Olver, R. R. "On Culture and Equivalence–II." In J. S. Bruner and others, *Studies in Cognitive Growth.* New York: Wiley, 1966.

Luria, A. R. *Cognitive Development: Its Cultural and Social Foundations.* Cambridge, Mass.: Harvard University Press, 1976.

Pérusse, D., Neale, M. C., Heath, A. C., and Eaves, L. J. "Human Parental Behavior: Evidence for Genetic Influence and Potential Implication for Gene-Culture Transmission." *Behavior Genetics,* 1994, *24,* 327–335.

Piaget, J. "Developments in Pedagogy." Reprinted in H. E. Gruber and J. J. Vonèche (eds.), *The Essential Piaget: An Interpretive Reference and Guide.* New York: Basic Books, 1977. (Originally published 1965.)

Rogoff, B. *Apprenticeship in Thinking.* New York: Cambridge University Press, 1990.

Saxe, G. B. "Developing Forms of Arithmetic Operations Among the Oksapmin of Papua New Guinea." *Developmental Psychology,* 1982, *18,* 583–594.

Saxe, G. B. *Culture and Cognitive Development: Studies in Mathematical Understanding.* Mahwah, N.J.: Erlbaum, 1991.

Scribner, S. "Vygotsky's Uses of History." In J. V. Wertsch (ed.), *Culture, Communication, and Cognition: Vygotskian Perspectives.* New York: Cambridge University Press, 1985.

Super, C. M., and Harkness, S. "The Developmental Niche: A Conceptualization at the Interface of Child and Culture." *International Journal of Behavioral Development,* 1986, *9,* 2–25.

Tomasello, M., Kruger, A. C., and Ratner, H. H. "Cultural Learning." *Behavioral and Brain Sciences,* 1993, *16,* 495–552.

Vogt, E. Z. *The Zinacantecos of Mexico: A Modern Maya Way of Life.* Austin, Tex.: Holt, Rinehart and Winston, 1990. (Originally published 1970.)

Vygotsky, L. S. *Mind in Society: The Development of Higher Psychological Processes.* Cambridge, Mass.: Harvard University Press, 1978.

PATRICIA M. GREENFIELD is professor of psychology at the University of California, Los Angeles.