CHAPTER 6

Developmental Continuity in Biocultural Context

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The major theme of our chapter is that cultural context is a source of ontogenetic continuity from birth to maturity. Our case in point is development among the Zinacantecos, an endogamous Mayan Indian society in Chiapas, Mexico (Vogt, 1969). We trace two aspects of behavioral style that are constant in Zinacanteco development from birth to maturity: (a) restrained motor activity and (b) the tendency to respond (rather than initiate).

Although these styles are very much a part of Zinacanteco culture, we hope to convince the reader that culture is not exclusively an environmental variable; cultures also have their sources in the gene pool of a particular population. Our argument is based on a unique set of data that allows us to trace how a distinctive *cultural* heritage intertwines with a distinctive *biological* heritage to produce continuity in development from birth to maturity. The existence of behavioral data from the newborn period permits us to consider innate behavioral characteristics and to demonstrate how distinctive newborn behavior, reinforced by a distinctive cultural context, develops into culturally appropriate adult behavior. This adult behavior then provides the sociocultural context that maintains and facilitates (Gottlieb, 1983) the innate characteristics of the next generation.

Note that here, and in the rest of the chapter, the term *innate* is used in the strict dictionary sense of "existing in one from birth" (Stein & Urdang, 1966). If we accept the concept of probabilistic epigenesis (Gottlieb, 1983)—development as a result of a bidirectional relationship between environmental stimulation and genetically controlled maturation, prenatally as well as

postnatally—there must always be both an environmental and a genetic component to any newborn behavioral function. *Differences* between individuals or, in this case, groups can, however, be a function of either genes, prenatal environment, or varying combinations of both. We present an argument leading to the conclusion that the primary influence differentiating the Zinacanteco newborn behavior pattern from the Euro–American one is genetic; prenatal environment provides a secondary influence.

The case of the Zinacantecos is used to provide new answers to some old questions concerning the role of cultural context in development and the extent to which there is constancy or change across different stages from birth to maturity. The use of evidence from a homogeneous and stable society enables the impact of cultural context to be thrown into high relief.

By examining Zinacanteco development, occurring in a very different cultural context, we become aware of aspects of our own cultural context that we normally take for granted, but that shape us nonetheless. The cultural context of development is not simply a set of socialization practices and values concerning the ideal endpoints of development. As we attempt to illustrate, it is also a framework by which members of a culture interpret specific characteristics of developing behavior in the light of environmental constraints. Interpretive practices express and reinforce cultural norms. These practices represent a subjective perspective shared by members of a culture.

A second theme of our chapter is that a universal, maturationally based plan of development (based in the panhuman gene pool) is the source of a fixed sequence of qualitatively distinct stages of development. The panhuman gene pool is also the source of the transcultural similarities in maternal behavior that maintain and facilitate stage progression in the next generation. This plan of developmental change provides the framework within which distinctive cultural styles of cognition and learning continuously unfold.

To summarize our conclusions, we can say: Universal forces—a maturational genetic program supported by cultural universals of basic care and socialization—fuel the *basic patterns of qualitative developmental change.* In contrast, culture-specific forces (both environmental and genetic) shape the *stylistic* aspects of these patterns, providing continuity in behavioral style across diverse developmental stages.

BACKGROUND

The Zinacantecos, living in isolated hamlets in highland Chiapas, had, at the time of the research, been extremely successful at preserving the Tzotzil

language and other aspects of a traditional Mayan way of life. In population genetics terms, they constituted a deme, an endogamous unit with no outmarriage.

Their native language is Tzotzil. Although children could learn to read and write Spanish in local elementary schools, schooling was relatively brief, of poor quality, and far from universal; indeed, almost no girls attended (Trosper, 1967). Most important, the Spanish-language schools represented the intrusion of a foreign culture.

The studies cited here were done between 1966 and 1970, at a point in Zinacanteco history when the culture was relatively stable, and the traditional ways were dominant (an overview of Zinacanteco culture is presented in Vogt, 1969). All of the studies were carried out in the native language of Tzotzil.

Brazelton, Robey, and Collier (1969; Brazelton, 1972) studied Zinacanteco newborns, in the process of developing the Brazelton Neonatal Behavioral Assessment Scales (Brazelton, 1973). They also studied infants from birth to 9 months, using the Bayley (1961) and Knobloch-Passamanick (Knobloch, Passamanick, & Sherard, 1966) tests.

Greenfield and Childs undertook several different studies. In one, young children were asked to manipulate a set of nesting cups (Greenfield, 1972; Greenfield, Brazelton, & Childs, 1989). Another study dealt with the acquisition of sibling kinship concepts (Greenfield, 1983; Greenfield & Childs 1978). In a third, children were asked to classify and reclassify familiar and unfamiliar objects by different attributes (Greenfield, 1974). In a fourth, children used colored sticks to continue and represent patterns (Childs & Greenfield, 1980; Greenfield, 1972, 1983; Greenfield & Childs, 1977; Greenfield & Lave, 1982). The last, and most complex, study concerned the teaching of weaving, an important skill for Zinacanteco girls (Childs & Greenfield, 1980; Greenfield, 1972, 1984). In 1988, for the first time, we drew all of these developmental studies together conceptually, to assess their implications for the issue of developmental continuity in cultural context and the impact of culture change (Greenfield et al., 1989).

THE ISSUE OF CONTINUITY

The question of ontogenetic continuity has been addressed most often from the point of view of stability of *individual differences* (e.g., Emde & Harmon, 1984; Kagan, 1971; Kagan & Moss, 1962). The stability of *cultural* differences through the life-span has been treated very little. In anthropology, the "culture and personality" school of the 1920s to the 1950s assumed the ontogenetic stability of cultural differences (embodied in the concept of "basic

personality structure") and explored their nature, relying on psychoanalytic and learning theories (e.g., Kardiner & Linton, 1939; Mead, 1928; Whiting, 1941; Whiting & Child, 1953). However, like other investigations based on these same frameworks, these studies did not succeed in building a solid empirical foundation and ultimately seemed to arrive at a dead end.

In 1973, Kagan and Klein published an influential article in the *American Psychologist* in which they concluded, on the basis of research in Guatemala, that developmental discontinuity was the rule on a cultural level: Large cross-cultural differences in environmental stimulation during infancy affected infant development but did not create a differential rate of cognitive development in later childhood (see also Kagan, 1976). This conclusion, concerning the lack of ontogenetic stability of cultural differences, paralleled the conclusions of the epoch in individual-difference research: it was concluded that there was little or no ability to predict individual differences in later development from individual differences in infancy (e.g., Kagan & Moss, 1962; Kagan, 1971; Kagan, Lapidus, & Moore, 1978; historical summary in Emde & Harmon, 1984, p. 1).

These conclusions, however, turned out to be premature. On the cultural level, Kagan, Klein, Finley, Rogoff, and Nolan (1979), using a wider variety and more difficult cognitive tasks in Guatemala and the United States, found cultural differences in rate and level of cognitive development. These differences did not imply discontinuity. On the contrary, they were correlated with the differences in infant stimulation and infant development that Kagan and Klein (1973; Kagan, 1976) had previously described.

On the level of individual differences within a culture, a new source of developmental continuity in personality has been found: the physiological processes that regulate behavioral inhibition to novelty. Kagan and colleagues have found continuity in extreme inhibition or shyness from infancy to age 7. This continuity of individual differences appears to be based on inherited variation in the reactivity of the sympathetic nervous system (Kagan, Reznick, & Snidman, 1988; Rosenberg & Kagan, 1987).

Reconceptualization of the problem has led to additional evidence of continuity of individual differences in the cognitive area as well. In their review, Bornstein and Sigman (1984) identified three possible types of developmental continuity: continuity of identical behavior, continuity of underlying process, and continuity of developmental status. Research utilizing the first and third definitions of continuity—identical behavior and developmental status—has yielded little or no evidence of stability of individual differences in cognition. The second definition, continuity of underlying process (similar to Kagan's [1971] "heterotypic continuity"), has turned out to be the most valuable and predictive. Recent analyses have explored the possibility that the superficial expression of a particular process can vary at different stages of the life cycle. Such analyses have succeeded in finding moderate continuity of underlying process expressed in developmentally

appropriate but superficially diverse manners at different points in the life cycle from birth through early adolescence (e.g., Bornstein, 1989; Fagan, 1984; Slater, Cooper, Rose, & Morison, 1989). An example is Fagan's finding that a preference for novelty in infancy predicts older children's IQ better than do infant mental exams.

In parallel fashion, we make a case for the stability of cultural differences from birth through maturity by pointing out the expression of these differences in diverse—albeit developmentally appropriate—forms at different points in development.

We agree with Piaget (1971) on the importance of a universal epigenetic plan of qualitatively distinct cognitive stages. However, within this stage sequence, we also have identified important elements of behavioral and cognitive style that are constant across all developmental periods from birth to maturity in Zinacantan. These elements are *culture specific.* Not only did their identification require the use of culturally meaningful situations and tasks, but, most important, our themes of cultural continuity could become visible only through a close analysis of the cultural context from the perspective of its members. Here, we were exceptionally fortunate: (a) before our studies, we were able to plan culture-fair and culture-specific tests on the foundation of 12 years of ethnographic fieldwork by the Harvard Chiapas Project; (b) we were given cultural training and colleagueship by Zinacanteco associates and American researchers experienced in Zinacantan (including members of our own team); and (c), looking back on our studies, we now have over 30 years of multidisciplinary study of Zinacantan on which to base our cultural analysis and interpretations.

In discussing the continuity of individual traits within a culture, researchers have stressed that long-term environmental support creates longitudinal constancy in individual development (Emde & Harmon, 1984; Kagan, 1984; Kagan & Moss, 1962). However, this long-term developmental support has typically been studied by developmental psychologists only on the level of an individual, rarely on that of a culture. Instead of trying to find and account for longitudinally constant differences *within* a culture, we are trying to find and account for longitudinally constant differences *between* cultures. Our conclusion is that cultural values provide just this long-term environmental support, yielding longitudinally constant cultural differences in behavior.

We begin by describing evidence that the Zinacantecos do in fact conform to a universal, species-specific plan of cognitive development, within which their distinctive cultural style unfolds.

TRANSCULTURAL NATURE OF DEVELOPMENTAL STAGES AND ADULT BEHAVIORS

When Brazelton and his colleagues tested Zinacanteco babies using the Gesell and Knobloch-Pasamanick tests, mental and motor items were passed in the

same order as in the United States (Brazelton, 1972; Brazelton et al., 1969). The sequence of behavioral milestones exhibited by Zinacanteco babies was indicative of a universal, maturationally based plan of infant development.

In a study involving the manipulation of graduated nesting cups, Zinacanteco children showed the same developmental sequence of strategies for combining the cups as children in the United States (Greenfield et al., 1989). Given their lack of familiarity with toys in general and nesting cups in particular, this sequence could not be a function of learning or other direct experience. Therefore it must have had its roots in a maturational potential, one that is most likely universal in the human species. Zinacanteco mothers, in teaching their children how to nest the cups, showed the same behavior as mothers in the United States: They adapted their teaching strategies in relation to the skill level of their children, not to the success of one strategy over another. These teaching interactions, elicited by the researchers, were a definite factor in the epigenesis of the developmental sequence.

In a study of comprehension of kinship terms, Zinacanteco children showed the same developmental process of decentration posited by Piagetian theory and research (Piaget, 1928), despite our culture-specific predictions based on the complexity and cultural importance of the Zinacanteco sibling system (Greenfield & Childs, 1978). As an example, we present the methods and results of this study in more detail than the others.

The interview procedure was adapted to the composition of each child's nuclear family. Before asking our subjects any questions, we elicited family trees from their mothers, which gave the names of all the household members and showed the kinship relationships among them. We used these family trees to compose a personal set of questions for each subject. Because we wanted to test comprehension rather than production of kinship terms, we phrased our questions so that they included the kinship terms and required one or more proper names for an answer. Where English has but two sibling terms (brother and sister), Tzotzil has six; each individual sibling word in Tzotzil must be translated by a whole phrase in English: older brother of a boy, younger brother of a boy, older brother of a girl, younger sister of a boy, older sister of a girl or boy, and younger sibling of a girl.

Our questions using Zinacanteco sibling terms were of two types: *ego centered* and *other centered.* Ego-centered questions concerned the relationship of an individual subject (or "ego") to his siblings, from the subject's own point of view. The following is an example of an ego-centered question for a boy named Chepil, with an older sister, Shunka, and a younger brother, Petul:

Question: What is the name of your older sister?

Answer: Shunka.

Other-centered questions involve understanding sibling relations from someone else's point of view. One type involves relations external to the subject or "ego":

Question: As for your younger brother, Petul, what is the name of his older sister?

Answer: Shunka.

A second type of other-centered question is about a relation to the subject. However, it asks the question from the point of view of the subject's sibling rather than from that of the subject and therefore involves a reversal of perspective. Here is an example:

Question: As for your younger brother, Petul, what is the name of his older brother?

Answer: Chepil (or me).

A scale of declining egocentrism went from ego-centered questions, to other-centered questions about the relations of a subject's siblings to each other, and on to other-centered questions involving a reversal of perspective. The developmental progression of increasing decentration is shown in the results in Fig. 6.1. Because factors that are specific to the Zinacanteco cultural environment (such as the semantic componential structure of the sibling system itself or the importance placed on the older brother–younger brother relationship) did not predict this transcultural sequence, culture-specific learning experiences cannot have been involved. Some sort of a universal process with a strong maturational component seems the most likely explanation. The fact that this sequence of development is exactly that predicted by Piaget's theory (1928) supports the conclusion of a universal, epigenetic plan of development.

The rate of progress to the final stage was also consonant with Piaget's age norms. Given the greater cognitive and linguistic complexity of sibling terms in Zinacantan, a common rate of development, added to a common sequence, must indicate either that the development of kinship concepts is a highly canalized (i.e., maturationally channeled) competence or that it receives greater environmental stimulation in Zinacantan.

In a classification/reclassification study, Zinacanteco children again passed through the same stages at the same ages as do children in the United States and Europe (Greenfield, 1974). In this study, children of varying ages from 4 to adolescent (13 to 18) were given arrays of cut flowers and wooden rods, which could be classified and reclassified according to different at-

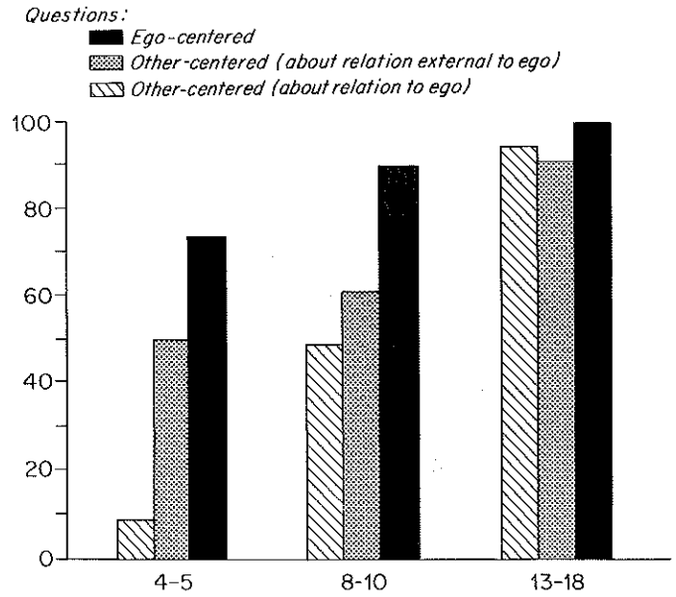

FIG. 6.1. Percentage of different types of questions answered correctly at different ages. "Ego" refers to the subject being questioned. Relations external to ego refer to relations of a subject's siblings to each other. Other-centered questions about a relation to ego involve a reversal of perspective. From "Understanding sibling concepts: A developmental study of kin terms in Zinacantan" (p. 349) by P. M. Greenfield and C. P. Childs, 1978. In P. Dasen (Ed.), *Piagetian psychology.* New York: Gardner Press. Reprinted by permission.

tributes: species, length, and color in the case of flowers; width, length, and color in the case of rods.

The youngest children, aged 4 and 5, were usually able to classify an array by a single criterion, but were not able to shift to a second. The 8-, 9-, and 10-year-olds, in contrast, were generally able to shift to a second attribute. The results were exactly as would be predicted from Piagetian theory: 4- and 5-year-olds were limited to using one-way classification, whereas 8- through 10-year-olds had added the skill of two-way classification.

In pattern-representation tasks, stages of development followed the sequence of increasing differentiation and hierarchical integration predicted by Werner's theory (1948). Here, subjects in the same age range were asked to place colored sticks side by side in a frame to continue or represent striped patterns.

Whereas the youngest children were limited to a global representational strategy (e.g., using the correct colors), older children could differentiate a simple pattern (e.g., alternation of red and white stripes), and the oldest children were able to combine two simple patterns (e.g., red–white and red–white–white) into a larger, hierarchically integrated pattern (repetitions of red–white–red–white–white).

In the weaving study, teachers showed the same sensitivity to the skill level of the learners that we observed in the nesting cup study, adjusting both the difficulty of the task and their teaching techniques. Essentially, they provided scaffolding (Wood, Bruner, & Ross, 1976) in the child's zone of proximal development (Vygotsky, 1962). This pattern of results also has been found in the United States (e.g., Kaye 1977; Greenfield 1984). The sensitivity of teaching techniques to the learner's stage of development may have helped actualize the potentialities in an epigenetic process.

All of the developmental domains described so far involve qualitatively distinct stages. An indicator of even greater qualitative developmental change from stage to stage is the qualitative differences between tasks appropriate at different age periods. For example, it would not be possible to ask a baby the questions from our kinship comprehension study. This fact clearly reflects a more global, clearly universal progression from nonverbal to linguistic modes of representation.

We now move from the potentially universal to the culture specific and from qualitative change to qualitative constancy in development, as we explore two aspects of Zinacanteco behavior: (a) physical activity level and (b) response versus individual initiative.

CULTURE-SPECIFIC PATTERNS

Restrained Motor Activity

The quality of restrained motor activity first appeared in newborn behavior and, in various guises in our studies, reappeared at all age levels up through adulthood. Placing restrained motor activity in its biocultural context, we now examine the specific examples of this constant stylistic feature in Zinacanteco development from birth to maturity.

In comparison with Caucasian babies in the United States, Brazelton and his colleagues (1969) found a low level of physical activity apparent in Zinacanteco infants at birth. This difference seemed to be, at least partly, a function of genetic factors. This conclusion stems from empirical evidence concerning the behavior of newborns from other ethnic groups. Chinese–American, Navajo, and Japanese (Goto Island) babies differed from Euro–American babies in many of the same ways that Zinacanteco babies did—for example, in their relatively low rate of motor activity (Brazelton et al., 1969; Brazelton, personal communication, 1988; Freedman, 1979; Freedman & Freedman, 1969). Although the Chinese–American sample *shared* critical elements affecting the prenatal environment with the Euro–American

sample (e.g., prenatal care, middle-class means to obtain good nutrition), the behavior of the newborns *differed* in the two groups. On the other hand, Zinacantecos, Navajos, Chinese–Americans, and Goto Islanders, sharing almost nothing relevant to the prenatal environment (e.g., nutrition, prenatal care) did share a common pattern of newborn behavior. Given the absence of a distinctive aspect of prenatal environment in common, the distinctive shared behavior must, logically, have some genetic basis. Indeed, these groups may have common genetic roots. It is now thought that Navajos have been part of a migration from Asia (Freedman, 1979); Mayan Indians also have Asian roots.

We are not arguing against the important role of prenatal environment in development. For example, Zinacanteco women themselves used controlled motor movements (Haviland, 1978); thus, pregnant mothers provided their unborn babies with a restrained style of prenatal movement environment, an environment that should have strengthened an epigenetic pathway toward quiet motor patterns.

We conclude, however, that a distinctive prenatal environment is not the *only* factor responsible for Zinacanteco newborns' low activity level. In accord with this conclusion, well-controlled behavior genetics studies in the United States have found infant activity level to have a significant heritable component (Goldsmith & Campos, 1982; Goldsmith & Gottesman, 1981).

The newborn's relatively low motor activity was immediately reinforced by the Zinacanteco culture. The cultural practice of swaddling, itself an adaptive protection against the cold of unheated Zinacanteco houses in highland Chiapas, restricted the infants' movements (Brazelton et al., 1969; Greenfield, 1972). Nursing at the slightest sign of movement further lessened motor activity (Brazelton et al., 1969).

These environmental forces thus enhanced the differences between the activity level of Zinacanteco and Euro–American babies in the United States. Zinacanteco babies had begun life relatively physically quiet and inactive, compared with babies born in the United States. Reinforced by different child-care practices in the two cultures, this cultural difference in level of physical activity increased during the first week (when the typical Euro–American baby is physically unrestricted in a crib, free to flail about at will). Such environmental reinforcement of innate differences provides an example on the level of *cultural* differences of the environment–gene correlations behavior geneticists have identified in their investigation of *individual* differences (e.g., Goldsmith, 1988; Plomin, DeFries, & Fulker, 1988; Scarr & McCartney, 1983). This example also translates a theoretical construct from behavior genetics into a concrete developmental process.

Diminished Zinacanteco motor activity manifested itself in other ways as development proceeded. Children tested in the first year of life, when compared with United States norms, showed a delay in the development of motor

skills that was greater than their slight delay in mental skill development (Brazelton et al., 1969). A low level of motor response at birth was also consistent with the paucity of small motor (eye–hand) experimentation observed during the first year of life in the infant tests and the nesting cup situation (Brazelton et al., 1969; Greenfield et al., 1989). There was evidence of low motoric activity in older children who sat observing for long periods when learning to weave (Childs & Greenfield, 1980; Greenfield, 1984). Less use of an active motoric strategy was also noticed in adults instructing babies in the nesting cup task: Mothers used the more physically aggressive teaching strategy of "shoving" the baby's hand much more rarely than mothers in the United States in a parallel situation (Greenfield et al., 1989; Kaye, 1977).

A low level of physical activity continued into adulthood. Restricted motion was adaptive for the Zinacanteco mother, who nearly always had a baby on her back and, during her childbearing years, had to perform work under this condition (Haviland 1978). "Never a people given to wild gesticulation even at their most excited, Zinacanteco physical restraint is most marked in the behavior of women" (Haviland, 1978, p. 243). Quite astonishingly, Leslie Haviland's description of female body movement is remarkably reminiscent of Brazelton et al.'s (1969) observations of Zinacanteco newborns:

> Feminine body movement is highly controlled and carried out in a narrow circumference. Women keep their upper arms tight to their bodies and rarely raise their hands or arms over their heads. . . . In short, Zinacanteco women never engage in sweeping, expansive gestures, nor do they allow their limbs to stray outward from their bodies, whether in work or in fun. (Haviland, 1978, p. 243)

This is not merely the way Zinacanteco women *actually* moved; this is also the way they were *supposed* to move. Although less extreme than for women, the aesthetic value for Zinacanteco men involved movement patterns that were equally constrained, in comparison with typical movement patterns in the United States (Devereaux [formerly Haviland], personal communication, July, 1989). Creating striking ontogenetic continuity, an innate newborn behavior ultimately became a culturally valued adult behavior. Values then constitute part of the environmental stimulation in a long-term process of probabilistic epigenesis.

The adult woman's restrained style of motor movements, itself a product of epigenetic development, created a prenatal motor environment for her own unborn child. The restrained style of movement of Zinacanteco females continued to provide a postnatal motor environment during the baby's first 2 years of life, when he or she was carried most of the time. In this way, the epigenesis of movement patterns in one generation has the potential to influence the epigenesis of movement patterns in the next.

In sum, restrained motor activity was a part of the developing Zinacanteco from birth to adulthood, at which point, in pregnant females, it provided a restrained movement environment for the unborn Zinacanteco baby, most likely helping to preserve this stylistic feature into the next generation.

Culture as an Interpretive Framework

The area of motor development is also a good arena for illustrating cultural context as an interpretive framework. Sophie Haviland, the daughter of American social scientists living in Zinacantan, walked at 9 months of age, about 5 months earlier than the Zinacanteco norms. According to her mother, sociologist/anthropologist Leslie Devereaux (formerly Haviland), in Zinacanteco eyes her precocious walking made her a "monster" because, in their particular environment, it was dangerous for a child to walk before understanding language. For example, Zinacanteco houses always have an open fire in the center. Because Sophie could propel herself motorically, yet lacked the understanding to stay away from the fire, there was a constant danger that she would fall in. Walking before the development of rational sense and understanding also was considered disruptive to others, as when Sophie would stagger into somebody's weaving.

Zinacantecos were horrified at the problems that resulted from Sophie's early walking. They were amused that her parents, unlike the typical Zinacanteco family, had to be on guard all the time to keep her from hurting herself or inadvertently creating some kind of damage (Haviland [a.k.a. Devereaux], personal communication, 1988).

Breaking cultural norms often reveals most dramatically what the norms are. The cultural context goes unnoticed until it is disrupted. In the case of motor development, Zinacanteco reactions to Sophie's deviation from the normal walking age make it clear that Zinacantecos do not merely *tolerate* but actually *value* late walking. In their cultural context, unlike ours, relatively late motor development had a positive social value. Even more important from a theoretical perspective is the fact that this norm was much more adaptive for survival in the Zinacanteco environment than our norm of *accelerating* motor development would be. From a methodological perspective, the breaking of cultural norms or values is a sure method to identify exactly what the norms or values are.

Culture as an interpretive framework for child-rearing behavior was revealed in another area. Zinacanteco mothers, unlike mothers in the United States, were in almost constant bodily contact with their babies and did not feel comfortable being physically separated from them during the day. Zinacanteco babies were believed to require body contact with caregivers to feel happy and free of fear (Haviland, 1978, p. 240). Zinacanteco mothers were therefore horrified when they saw her mother put Sophie down; they would display their reaction through comments such as "How can you put her down?". Indeed, they blamed Sophie's frequent crying (in comparison with a Zinacanteco baby) on the physical separation created by what they considered to be a most inadequate child-care practice! Again, reactions to the inadvertent deviation from a norm revealed cultural values.

Such reactions can serve as a guide for the unbiased, scientific interpretation of rearing practices in different cultures: It is not fair to assess different cultures by the same standards. It is not simply a question of intercultural variation in child-rearing practices. When there are two very different philosophies, each generating a different pattern of care and development (Ochs & Schieffelin, 1984), people subscribing to one or the other philosophy will each consider the ways of bringing up children in the other culture as not just different but inferior (cf. Cole & Bruner, 1971). These philosophies of child rearing themselves constitute important aspects of the cultural context of child development.

Responding Instead of Initiating

The tendency to respond rather than initiate was a constant in Zinacanteco learning from birth to maturity. Placing this tendency in biocultural context, we now trace the varying manifestations of this stylistic feature at different points in development.

Zinacanteco newborns were notable for being more alert than Caucasian babies in the United States. They attentively observed their surroundings for much longer periods than Caucasian babies in the United States, laying the foundation for later observational learning (Brazelton et al., 1969). They did not cry intensely or flail about, demanding that someone react to them.

Zinacanteco newborns shared this behavioral quality, as they did their relative motor inactivity, with genetically related but environmentally unrelated groups (Freedman, 1979; Freedman & Freedman, 1969). For example, prenatal nutrition and the general pregnancy experience of Chinese–American and Euro–American mothers (both groups born in the United States) had to be much more similar to each other than to that of pregnant Zinacanteco mothers, who (a) relied on a staple diet of corn and beans, supplemented by small quantities of vegetables and fruit, with extra meat, eggs, and beans during pregnancy (Anschuetz, 1966) and (b) continued their subsistence work during pregnancy. Yet the Chinese–American newborns differed in their attentional qualities from the Euro–American newborns, with whom they shared important features of the prenatal environment; instead they resembled the Zinacanteco newborns, with whom they shared an Asian ancestry.

Without forgetting the crucial role of the environment in epigenesis, we are led again to the conclusion that there is a genetic component to this newborn behavior of attentiveness. This conclusion is buttressed by the results of behavior genetics studies that, in finding greater correlations for attention in monozygotic than in dizygotic infant twin pairs, conclude that attention has a significant component of heritability (Freedman, 1965; Freedman & Keller, 1963; Goldsmith & Gottesman, 1981).

Looking at newborn attention from the perspective of prenatal environment, it is possible that the prenatal environmental factors potentially reinforcing Zinacanteco newborns' restrained motor movements could have had an indirect effect on attentiveness (see Greenfield, Brazelton, & Childs, for a fuller discussion of this point). However, the most obvious prenatal factor, nutrition, did not seem to be a factor at all. One aspect of Zinacanteco newborn attention patterns was their speedier habituation to a repeated stimulus. Given the correlation of speed of infant visual habituation with later measures of infant intelligence (Bornstein, 1989; Bornstein & Sigman, 1984), the most likely prenatal influence would be nutrition, known to influence the growth of intelligence. Yet, by our standards, the Zinacanteco diet, based heavily on corn and beans, would be considered nutritionally less adequate than the typical Euro–American diet. But the Euro–American newborns studied by Brazelton et al. (1969) were slower to habituate than were Zinacanteco newborns. The evidence is therefore strong that the role of prenatal environment in producing group differences between Zinacanteco and Euro–American newborns in attention is, at most, a secondary one.

The Zinacanteco newborn's tendency to respond rather than elicit response from the environment was reinforced and strengthened by cultural values expressed by adults, even at a baby's birth. In a birth ritual, each newborn received the adult tools that symbolized its predetermined role in Zinacanteco society (Brazelton, 1972; Brazelton et al., 1969; Laughlin, 1980). This pattern of response versus initiation was reflected again and again in the Zinacanteco child's later development.

In the infant tests carried out by Brazelton et al. (1969), infants showed little interest in playing with an object beyond imitation. In frequent nursing (up to 90 times a day), infants found their needs satisfied probably before they were aware of them and could take the initiative to express them. Children playing with nesting cups did not hang on to them in an egocentric fashion, as 1-year-old American children did. They developed investment in objects later and seemed to have less interest in manipulating them on their own (Greenfield, Brazelton, & Childs, 1989).

We had expected children who were asked to classify and reclassify flowers and rods to find the culturally familiar flowers easier to work with. We found instead that, influenced by the Zinacanteco concept of there being only one true, or *batz'i*, way to do things, the children found it relatively difficult to

sort the flowers in ways that flowers were not ordinarily sorted. Once they had sorted flowers into bouquets by species and length, they did not (or could not) ignore those Zinacanteco attributes and re-sort by color, a culturally unimportant basis for making bouquets (Greenfield, 1974). Thus, Zinacanteco children tended to sort flowers according to Zinacanteco custom, rather than to initiate new ways of grouping objects.

Another manifestation of response versus initiation was an imitative rather than innovative approach to tasks. This quality appeared in the pattern-representation study. One of the pattern tasks was to complete a "growing" pattern with three alternative continuations (see Fig. 6.2). The growing pattern was treated imitatively by all the unschooled children, who produced repetitive or mirror-image continuations. That schooling could promote individual innovation (as Zinacantecos feared) was indicated most dramatically by the fact that, in representing culturally novel patterns, the only subjects to transcend the model and take a "progressive" approach to the growing pattern had been to school (Greenfield & Childs, 1977).

Although we expected girls who wove to have more success with all the pattern-representation tasks, this was not the case. The weaving girls, none of whom had been to school, had less success than nonweaving boys, both unschooled and schooled, in continuing all the unusual (i.e., not Zinacanteco)

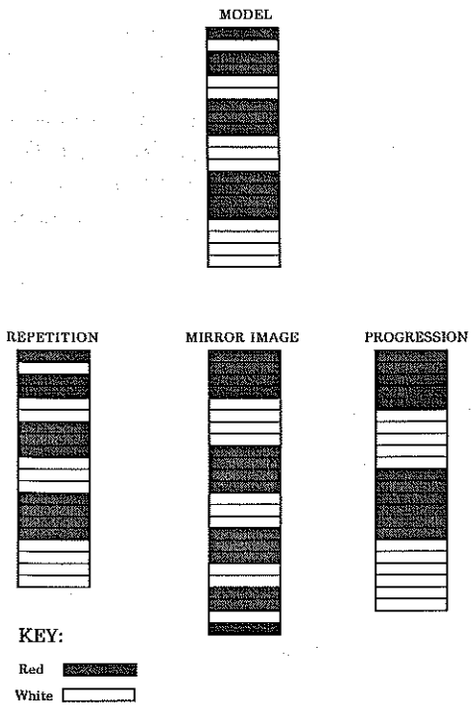

FIG. 6.2. Model for growing pattern and three possible continuations. From "Weaving, color terms, and pattern representation: Cultural influences and cognitive development among the Zinacantecos of southern Mexico" by P. M. Greenfield and C. P. Childs, 1977, *Interamerican Journal of Psychology, 11*, p. 29. Adapted by permission.

patterns (Greenfield & Childs, 1977). As there were only three Zinacanteco woven patterns in all, learning to weave consisted of learning to weave these three patterns. The weaving girls had difficulty continuing the novel patterns. Boys, both unschooled and schooled, showed the influence of the outside world in their superior ability to transfer skills, successfully continuing the novel patterns (Greenfield & Childs, 1977).

Like Zinacanteco newborns, the girls in the weaving study showed a remarkable ability to observe an adult teacher attentively for long periods of time. They did not often initiate conversation (Childs & Greenfield, 1980; Greenfield, 1984). Commands from teacher to learner were of primary importance as a teaching technique, both for weaving (Childs & Greenfield, 1980; Greenfield, 1984) and for nesting cups (Greenfield et al., 1989), illustrating the Zinacanteco principle of the dominance of the junior by the senior, based on the culturally central relationship of *bankilal* and *itz'inal* or older and younger brothers.

When the learner reached adulthood, the expectation that younger respond to older remained; the new adult was then able to switch roles, becoming the dominant teacher whom a responsive weaving learner watched and obeyed. There was no encouragement of individual initiative.

Contrast with the American Way

Our analysis of the implicit differences between instruction and learning in Zinacantan and the United States was dramatically validated by Marta Turok's (1972) description of the conflicting cultural assumptions that were revealed when she, a college student from the United States, began learning how to weave from a Zinacanteco "teacher":

> When I began taking back-strap loom weaving from Tonik, an older Zinacanteco woman, I became increasingly restless, when after two months of what I termed observation and what she termed learning, I had not touched the loom. Many times she would verbally call my attention to an obscure technical point, or when she would finish a certain step she would say, "You have seen me do it. Now you have learned." I wanted to shout back, "No, I haven't! Because I have not tried it myself." However, it was she who decided when I was ready to touch the loom, and my initial clumsiness brought about comments such as, "Cabeza de pollo!" (chicken head) You have not watched me! You have not learned!". (Turok, 1972, pp. 1–2)

This description affirms the contrasting role of observation and active experimentation in the two cultures.

We have seen that striking responsiveness to the environment appears in various developmentally appropriate forms at different stages of development. Behind this predominance of response over initiative on the part of Zinacanteco children lay the traditional culture of Zinacantan with its *batz'i* (true) way of doing things and its emphasis on the *bankilal/itzi'nal* (senior/junior) relationship. The attentiveness of Zinacanteco newborns paved the way for learning the "true" (Zinacanteco) way, through the junior's close observation of and response to a senior. Because the maintenance of Zinacanteco tradition, the "true" way, was perhaps the highest ideal in Zinacanteco culture, the predisposition to respond both supported and was supported by a fundamental cultural value.

Actual and Potential Effects of Culture Change

Cultures can change, however. Now, in the 1980s, 15 to 20 years after these developmental studies were done, Zinacantecos own and operate many of the trucks used for commerce and transportation in the highlands around the Spanish-speaking Mexican town of San Cristóbal de las Casas. They have become involved in other capitalistic enterprises as well (Frank Cancian, 1985). Zinacanteco culture is currently becoming more entrepreneurial and technological.

Although child-rearing practices are very resistant to change, we would predict that methods of early socialization would gradually come to place relatively greater emphasis on innovation, individual initiative, and manipulation of objects, and relatively less on responsiveness to others and maintenance of tradition. Going one step further, we would predict that new methods of weaving instruction, emphasizing trial and error on the part of the learner, would lead, in turn, to new woven patterns and constant pattern innovation. The prediction about novel patterns has in fact been borne out; new woven patterns are now common in Zinacantan (Frank Cancian, personal communication 1987). The instructional process and patterns of senior–junior interaction remain to be studied to see if there has been movement toward a more active, experimental approach on the part of the learner.

CONCLUSIONS

We have demonstrated that two stylistic aspects of behavior—restrained motor activity and the tendency to respond rather than initiate—constitute underlying behavioral processes that reappear in different surface manifestations again and again in Zinacanteco development. Each thread of con-

stancy is equally rooted in the innate behavior of Zinacanteco newborns and the value system of Zinacanteco culture.

We hope to have convinced the reader that it is possible to find constancy in developmental style from birth to maturity and that the source of this constancy lies in a specific cultural context—in this case, the culture of Zinacantan. At the same time, we see that cultural-specific style occurs within the framework of transcultural patterns of child development and maternal behavior. The force behind these transcultural patterns of development seems to be epigenetically guided patterns of maturation and adaptation. Surprisingly, we find that cultural style, as well as transcultural patterns, has its roots in an epigenetic process, founded not on the species-specific genes that produce transcultural patterns of cognitive development, but on a population-specific genetic heritage, which, on the basis of newborn behavioral studies, appears to characterize peoples with Asian roots, in contrast to those with a European (or African, Brazelton, Koslowski, & Tronick, 1976) heritage.

We now expand our answer to the question concerning the relationship between culture-specific and universal forces in development. Universal forces—a maturational genetic program supported by cultural universals of basic care and socialization—fuel the *basic patterns of qualitative developmental change.* Increasingly, there is evidence that different genes switch on and off at different points in development, providing a genetic basis for change as well as constancy (Goldsmith, 1984).

At the same time, a culture-appropriate genotype, supported by a specific cultural context, shapes the *stylistic* aspects of these patterns, providing continuity and constancy in behavioral style across diverse developmental stages.

The modern behavioral genetic concepts of gene–environment correlation and the genetic mediation of environmental effects (Goldsmith, 1988; Plomin et al., 1988; Plomin, DeFries, & Loehlin, 1977; Scarr & McCartney, 1983) provide a good model for the intimate and complex interrelations between genes and culture that are suggested by the studies of Zinacanteco development summarized and analyzed in this chapter. These studies have led us to the conclusion that the cultural environment, i.e., the cultural context, in which the developing child is socialized has a genetic foundation *itself.* The socializing adults are also biological creatures who themselves have developed from the newborn period. The motorically restrained Zinacanteco mother was once the inactive Zinacanteco newborn. The attentive young Zinacanteco weaver was once the visually attentive newborn.

What we have seen in the preceding material is that innate characteristics, such as restrained motoric activity, at least partly founded in the genotype, become adult characteristics that influence the next generation. For example, the low motoric activity of Zinacanteco newborns becomes the restrained movements of the Zinacanteco mother, which create a quiet motor environment for the developing fetus (Brazelton, 1972) and carried baby; in addition, restrained motor movement is manifest directly in socializing techniques, as when Zinacanteco mothers were observed to use infrequently the "shove" strategy (more often used by American mothers) when they taught their toddlers how to do a manipulative task.

Finally, innate characteristics, such as restrained motor movement and great skill in observing, become values and norms that govern adult behavior: the "is" of biology is transformed into the "ought" of culture. We are led to the curious conclusion that cultural values in part derive from a culture's ability to create a preferred stereotype of its own average genotype. Biology is not only part of the *universal* cultural context, as has been recognized before (e.g., Konner, 1982); it is also part of the *specific* cultural context that distinguishes one culture from another.

Evolutionary Implications

From an evolutionary perspective, the stage is set for the coevolution of culture and genes. Whereas earlier accounts had considered this process from the point of view of universal characteristics of human culture (Lumsden & Wilson, 1980), our account of the Zinacantecos points to the possibility of a coevolution of the specific cultural traits and the genes belonging to a particular social group.

We have already outlined the reciprocal influence between biology and culture: The innate characteristics of the typical Zinacanteco newborn were not only naturally well adapted to but also reinforced by the cultural environment he or she met, an environment provided by adults who themselves belonged to the same gene pool. Thus, the process of intergenerational transmission involved a process of reciprocal gene–culture influence: the newborn's genetically given behavior, already reinforced by the prenatal environment provided by a member of the same gene–culture pool, provided a foundation predisposed to receive the socializing message of this particular culture, while the adults in the culture, themselves members of the same gene–culture pool, further reinforced the innate qualities of the newborn as the child moved through qualitatively distinct developmental stages of learning and cognition from birth to maturity.

This reciprocal process was also well suited to survival in the physical environment that the Zinacantecos face. For example, the motorically quiet baby adapted well to swaddling, a practice that enhanced the chances of survival in the cold climate of highland Chiapas, given that Zinacantecos often slept on the cold earth in houses that went unheated at night (Greenfield, 1972). The motor restriction of Zinacanteco infants as they were carried

on the backs of their mothers or other caregivers also kept them out of harm's way, away from the open fire in the middle of the house, away from the packed earth flooring both indoors and out that would otherwise end up going from dirty hands to open mouth.

If the innate qualities of typical Zinacanteco newborns suited them for survival-enhancing care practices, then there would be a selective advantage in favor of those infants that did adapt well to these conditions. Over time, the gene pool would come to contain more and more of this genetic pattern.

The first author's (Greenfield's) experience with her own motorically active 10-month-old baby in Navencauk provides an interesting confirmatory case in point. Matthew Greenfield would not stay happily in a back carrier but wanted to crawl about in the dirt, picking up peach peels and putting them in his mouth; given the absence of plumbing, it was not even easy to clean his hands and face. After a few days, his mother realized that Matthew's behavior was a danger to himself and that there were no possible care practices that would allow a baby with his active temperament to adapt safely to this particular environment. Consequently, she stopped bringing him to Navencauk and simply left him with babysitters and his sister in their house in San Cristóbal de las Casas, a warmer house with a wooden floor and modern plumbing.

Given the absence of medical care and the high infant mortality rate at that time in Zinacantan, one can imagine extremely strong selective pressure favoring the survival in the cold climate of highland Chiapas of the motorically quiet baby who is willing to remain swaddled and wrapped. Indeed, most of the attention in evolutionary theory has been given to differential rates of reproduction stemming from the young-adult part of the life cycle: courtship, mating, and reproduction. However, a child who dies in infancy clearly will not reproduce at all. In environments where there is a high infant mortality rate, the factors governing infant survival will have much more effect on differential reproduction than any factor in the courtship, mating, or childbearing phase of the life-cycle. Any quality that enhances survival at this period of life will also greatly enhance the chances of successful reproduction.

The reciprocal influence of genes and culture, occurring in a particular physical environment, exerts a selective pressure on the gene pool and becomes gene–culture coevolution. Such coevolution, though perhaps most dramatic at infancy, is not limited to this period. It is easy to envisage how the Zinacantecos' developmental course, with its constant stylistic qualities that stretched from birth to maturity, clearly reflected a reciprocal biology–culture influence. For example, the restrained movements of Zinacanteco women were made easier to develop by the motor quietness with which they are typically born. But this innate quality was certainly reinforced by the cultural value that held that this is how a Zinacanteco woman *should* move. And finally, one can speculate that women who *did* move this way would be

considered more marriageable and sexually attractive and therefore might have a slight reproductive advantage over other women who moved more awkwardly, from the Zinacanteco point of view.

Similarly, the typical Zinacanteco girl baby who is born attentive, after having this quality reinforced by socialization during the first few years of life, would ultimately have an easier time learning to weave—given the observational methods stressed in Zinacanteco pedagogy—than someone like the American student, Marta Turok, who was continually frustrated by the absence of opportunities given to her by her Zinacanteco weaving teacher to act and initiate action (Turok, 1972).

Zinacantecos did, in fact, consider weaving to be a skill that makes a girl more marriageable; and so one can speculate that the innate quality of visual attentiveness, reinforced by learning situations that utilize and depend on it, would also bestow a small selective advantage on its bearers. Again, the mutual influence of genes and culture logically leads to their coevolution, with the culturally favored qualities continually selected for—to a greater extent where relevant to infant survival and to a lesser extent where relevant to courtship and adult reproductive behavior.

However, this scenario holds only in a constant environment. What happens when a culture and its environment change? Now that entrepreneurship has come into Zinacantan, the definition of adaptive behaviors may shift.

Interestingly enough, Zinacantecos used to worry that schooling would make children, especially girls, stop obeying their parents (Trosper, 1967). In our weaving research, we had an indication that schooling could make a girl less verbally passive, more verbally assertive (Childs & Greenfield, 1980). When the study was carried out, almost no Zinacanteco girls were sent to school. Now that has changed. Perhaps this is a sign that a more assertive female who can take the initiative is becoming socially acceptable under the new conditions of economic entrepreneurship.

Future study will reveal whether pedagogical methods have shifted to encourage innovation and initiative. If so, this cultural evolution may also have an influence on genetic evolution. Innovators and initiators may become more economically successful, allowing them to raise more children successfully in a more money-oriented economy and under more modern living conditions. At that point, the selective pressures may no longer favor the attentive but motorically quiet Zinacanteco baby, but rather the active, initiating baby more valued in our own culture. It will be a challenge to develop research methods that can address complex questions concerning the coevolution of a gene pool and its culture.

The stable culture and isolated gene pool of the Zinacantecos into the 1970s have allowed us to see the reciprocal influence of genes and culture in the maintenance of a constant behavioral style, constant from birth to maturity and, equally important, constant from generation to generation.

The conceptualization of the reciprocal influences of biology and cultural context in a *constant* environmental context has helped us to frame the questions that must be answered if we are to understand equally well the interacting roles of biology and culture in the process of human evolutionary *change.* Clearly, an understanding of the cultural context and its role in development will be crucial elements in our scientific understanding of how groups of human beings have evolved biologically and will continue to evolve in the future.

ACKNOWLEDGMENT

This chapter was prepared with the aid of the Gold Shield Faculty Prize, awarded to the first author. We are grateful to Leslie Devereux (formerly Haviland) for sharing her insightful observations of Zinacanteco behavior and values with us. Our thanks to T. Berry Brazelton, whose research and thoughts on the Zinacantecos stimulated our own, to Evon Z. and Nan Vogt, who shared the resources of the Harvard Chiapas Project, and to Xun Pavlu, our indispensable assistant in Navencauk.

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