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FROM BIRTH TO MATURITY IN ZINACANTAN: ONTOGENESIS IN CULTURAL CONTEXT

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"For in the newborn baby is the future of our world."
Zinacanteco saying

Romin Teratol, of Zinacantán, described the birth of his son Antun as follows:

Well, after we ate, my wife's stomach was massaged, kneaded. But she hardly sat down at all. Standing there she did what had to be done. She got her children's meal for them. When her pain kept coming then she knelt and leaned on a chair. . . .

Well, the midwife was kneading her back, but [the midwife] wasn't strong.

So then I, myself, kneaded her back and then in a minute or two the baby came. And in a minute or two the afterbirth which remained appeared, too. . . .

When she finished washing it off, finished bathing the baby, she dressed it in its little clothes. She wrapped it carefully in blankets. And then it was given three chilies to hold so that it would . . . know to buy chili when it grew up. It was given a billhook, a digging stick, an axe, and a [strip of] palm so that it would learn to weave palm.

Then when the midwife finished giving them to it she censed [the baby]. She prayed to the tutelary gods so they would gather up its little soul at the meeting place. That's what the midwife prayed. When she finished praying she gave [the baby] to its mother to cuddle. It slept with her [Laughlin 1980:157-158].

Ontogenesis, the biologically grounded maturation of an individual, provides

an opportunity to analyze development in the context of two interrelated environmental adaptations: adaptation for physical survival and adaptation to cultural goals, values, and practices. Romin Teratol's description of the beginning of a new Zinacanteco life reveals each of these elements. In so doing, it anticipates themes that we shall use to integrate a series of developmental studies carried out in Zinacantán from 1966 to 1970 (Brazelton et al. 1969; Greenfield 1974; Greenfield and Childs 1977, 1978; Childs and Greenfield 1980; Appendix A).

In Romin Teratol's description, the maturation of the developing fetus culminates in the biological event of birth. The physical well-being of the mother is attended to in the kneading of her back, which relaxes her muscles, enhancing the safe voyage (and survival) of the baby. The mother is guided by Zinacanteco cultural practice to give birth in a vertical position (Anschuetz 1966), thus letting the force of gravity and the position of the pelvic bones facilitate the baby's passage and, therefore, his chances for survival (Caldeyro-Barcia 1979; Russell 1969). Without the availability of medical intervention, the Zinacanteco culture cannot afford the "luxury" of the much more dangerous supine position common in our own birthing practices (Caldeyro-Barcia 1979). The midwife's prayer for the soul of the baby reflects awareness of the very real precariousness of a new Zinacanteco life.

In ritually placing the work implements of a grown man in the newborn's hand, Zinacantecos look to the baby's future, valuing his sex and identity and evoking and reinforcing the cultural goal of the baby's adult role. The baby's value as a future member of society is recognized and enhanced.

OVERVIEW OF THE DEVELOPMENTAL STUDIES

Between the years 1966 and 1970, several detailed developmental studies were carried out with Zinacanteco children. Brazelton, Robey, and Collier (1969; Brazelton 1972) studied Zinacanteco newborns, in the process developing the Brazelton Neonatal Behavioral Assessment Scale (Brazelton 1973, 1984). They also studied infants from birth to nine months, using the Bailey and Knobloch-Passamanick tests (Brazelton et al. 1969; Brazelton 1972). Greenfield and Childs undertook several different studies. In one, young children were asked to manipulate a set of nesting cups (Greenfield 1972b; see Appendix A for procedural details). Another study dealt with the acquisition of sibling kinship concepts (Greenfield and Childs 1978; Greenfield 1983). In a third, children were asked to classify and reclassify objects by different attributes (Greenfield 1974). In a fourth, children used colored sticks to continue and represent patterns (Greenfield 1972b; Greenfield and Childs 1977; Childs and Greenfield 1980; Greenfield and Lave 1982; Greenfield 1983). The last, and most complex, study concerned the teaching of weaving, an important skill for Zinacanteco girls (Greenfield 1972b; Childs and Greenfield 1980; Greenfield 1984). In this essay, we seek to draw all these developmental studies together for the first time.

Our studies primarily reflect the perspectives of pediatrics and cross-cultural developmental psychology. In this essay, we draw upon the predominantly anthropological and sociological perspectives provided by other members of the Harvard Chiapas Project to interpret our results (Anschuetz 1966; Blanco and Chodorow 1964; Bricker 1973b; Cancian 1963, 1964, 1971a, 1971b; Collier 1969; Haviland 1978; Cancian 1985; Laughlin 1980; Miyamoto 1969; Trosper 1967; Turok 1972; Vogt 1969b). Leslie Haviland's work is particularly valuable, for it provides an insider's perspective on socialization and child rearing, thereby permitting the systematic observations of outsiders to be understood and interpreted from the Zinacanteco point of view. By integrating our observations with those of others who worked in Zinacantán, we are able to obtain a clear picture of how the innate qualities of Zinacanteco newborns and subsequent patterns of interaction between children and adults work together with Zinacanteco values to maintain adaptations for physical survival, as well as the cultural continuity so valued in Zinacantán.

DEVELOPMENT THROUGH INFANCY

Zinacanteco cultural practices involving infant and child care were remarkably uniform. As in other nontechnological cultures with extended families, knowledge was passed on by experienced older family members at the time of birth and thereafter. No special rites or practices were carried out while a woman was pregnant, and no pharmacologic agents were given before or during delivery. The midwife, always present during childbirth, did not employ any particular obstetrical techniques, but supported and encouraged the mother in labor (Anschuetz 1966). She led the assembled extended family in supportive groaning with each of the mother's labor pains. The mother knelt in front of her own mother, who caressed her. Her husband was at her back, pulling on the cinch at her waist with each labor pain. This effectively put pressure on the fundus of the uterus and helped to deliver the baby. The atmosphere in the house was one of support and celebration, with the entire extended family participating.

Immediately after birth, elaborate rituals were performed, with the newborn lying naked near the fire, a blanket at his or her back. Prayers and incantations by the midwife exhorted the gods to bestow on the child all the manly or womanly attributes necessary for success in the Zinacanteco world. It was at this point that various appropriate implements were placed in the baby's hand, representing his or her future role as an adult male or female. Romin Teratol's description has introduced the reader to the implements given to a newborn boy. For a girl, cooking and grinding utensils, weaving tools, and flowers were placed in her newborn grasp to reinforce her future feminine role.²

The infant was then clothed.³ A long heavy skirt extending beyond the feet, which was worn throughout the first year by both sexes, was held in place by a wide belt wrapped firmly around the abdomen. Then the newborn was swaddled in additional layers of blankets to protect the baby from "losing parts of his

soul." This swaddling acted as a constant suppressant to motor activity (Brazelton et al. 1966; Brazelton et al. 1969), as well as defending the baby from outside evil. In the presence of outsiders, infants' faces were covered except during feedings, especially during the first three months, to ward off illness and effects of "the evil eye." Strangers who came into a household with a baby in it were not supposed to look the baby in the eye until having protected the baby from the evil eye by kissing and blowing the baby on the wrist (Leslie Haviland, personal communication, September, 1988).

During the first month after delivery, the mother was confined, with the infant held wrapped in her arms or laid supine beside her as it rested. Thereafter, the child was carried in a sling on the mother's or another woman's back when not feeding. Leslie Haviland provides a detailed view of the sling and how it operates both in relation to the baby's needs and development and in relation to the mother's work life:

Infants up to the age of about one year spend most of their time bound to their mothers by a woven carrying cloth. The cloth is a broad rectangle folded in half to form a triangle, one point going over the mothers shoulder, one under her opposite arm, and the third tucked tightly up under the infant. The two free points are tied in a knot in such a way that it supports the head of a young infant; it also more or less immobilizes its feet and at least one of its arms. The infant faces the mother's back, its head turned to one side. As children grow bigger and stronger they begin to assume a sitting position in the sling, with legs bent and tucked to one side. By the time a child is nearing one year of age, it can almost stand in the sling, raise its head to see over its mother's shoulder, and it can use both hands. This sling method allows the mother to swing the infant around to a position to which it can nurse comfortably from her breast without removing it from the sling, while maintaining most of the support it affords.

This method of carrying leaves a mother's two hands free to cook, to wash clothing, to walk around and carry things quite freely. Women can be seen carrying loads of wood or a jug of water by a tumpline, a child slung in its cloth hanging forward from her shoulder [Haviland 1978:239-240].

Siblings often cared for infants, carrying them on their backs in imitation of the mother, though rarely playing with them (Blanco and Chodorow 1964). The mother played with the baby when she was in the company of other women and children or close male family members. When other male visitors arrived, the baby was immediately covered up and put on the mother's back.

Because of how the baby was carried in the sling and positioned for care-giving activities, eye-to-eye contact was much less frequent than in our culture (Brazelton et al. 1969; Leslie Haviland, personal communication, September,

1988). Similarly, giving a baby objects or toys was not valued by the Zinacantecos and occurred infrequently (Brazelton et al. 1969; Leslie Haviland, personal communication, September, 1988).

While most babies were given short opportunities to crawl on the ground (Haviland 1978), babies were not put on the floor to explore on their own. This was a protective adaptation against disease in an environment where the floor was simply dirt, and outdoors the ground often had "organic" garbage, such as peach pits, on it. Because an open fire was the center of every one-room house, babies were "usually held or carried, to keep them out of danger" (Haviland 1978:240).

Striking in this culture was the frequent nursing of the infant, facilitated by the dress of adult women—a cotton blouse, slit deeply under the arms to provide easy access to the breast (Brazelton et al. 1969). Breast-feeding provided abundant opportunities for mother-infant interaction. In Zinacantán, social interaction occurred in a variety of sensory modalities. Because babies were carried, wrapped up, on the back, kinesthetic and tactile forms of interaction predominated over visual stimulation. Covering the baby's head to avoid the evil eye reduced visual stimulation in the first year of life.

On the other hand, 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 felt to require body contact with care givers to feel happy and free of fear (Haviland 1978:240). Leslie Haviland raised her own baby, Sophie, in a Zinacanteco environment. Zinacanteco mothers were horrified when they saw Leslie put Sophie down; they would display their reaction through comments like, "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 practice.

This reaction makes an important point about the study of rearing practices in different cultures: it is not fair to assess different cultures by the same measure. It is not simply a question of intercultural variation in child-rearing practices. Often there are two very different philosophies, each of which generates a different pattern of care and development (Ochs and 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 worse (cf. Cole and Bruner 1971).

Description of Newborn and Infancy Study

Brazelton, Robey, and Collier carried out the major portion of this study during the summers of 1966 and 1967. In both summers, two pediatricians participated for one month each, while an anthropologist and a Zinacanteco assistant located subjects and interpreted language and cultural practices. The study consisted of three parts. The first focused on characteristics of the newborn at birth and in the first week of life.

Procedures for Observing Newborns. We observed two deliveries and were finally allowed to examine a total of five neonates several times in this first week of life. Until we were allowed to participate in deliveries, we were considered "dangerous" and were not allowed to handle their vulnerable newborns, for fear of the "evil eye" we might convey.

The observations of the newborns fell into three categories:

1. An unstructured observation period of thirty minutes, in which the infant was with his mother. At this time, we recorded spontaneous activity and the neonate's responses to stimuli that occurred naturally—environmental sounds, light changes, handling by the caretakers, and internal stimuli from within the baby. Of particular interest to us was the infant's use of motor activity and states of consciousness, that is, how the infant moved from one state to another, the buildup of tension before nursing, and the mode of falling asleep afterward.

2. A pediatric examination was made on each visit, with special attention given to the infant's maturity, state of nutrition, and hydration.

3. A neurological-behavioral evaluation was given to each infant at different points in the first week of life (Brazelton Neonatal Behavioral Assessment Scale).

The Brazelton Neonatal Behavioral Assessment Scale. The Brazelton scale (Brazelton 1973, 1984) was developed to assess the dynamic processes of behavioral organization and development in the neonate. It is a psychological scale for the neonate and, as described by Als, Tronick, Adamson, and Brazelton (1976), views the infant as part of a reciprocal, interactive feedback system between infant and care giver. While the exam includes the assessment of reflex responses, it focuses on the infant's capability to respond to the kind of stimuli that care givers present in an interactive situation and is designed to capture the baby's coping and adaptive strategies (for a detailed description of the scale, see Brazelton 1973, 1984).

Procedures for Studying the Infant's Social Environment and Development in the First Year. The second part of the study focused on mother-infant interaction. Four-hour observations of interaction were made using infants of different ages from birth through the first nine months of life. Coding was based on Rheingold's (1960) categories; we focused on whether mother or infant initiated the interplay, its purpose, and its outcome.

In the third part of the study, we focused on developmental milestones during the first year. However, testing after nine months of age became almost impossible because of intense stranger anxiety. We used the Knoblock-Pasamanick (Knobloch et al. 1966) adaptation of the Gesell scales the first summer and the Bayley (1961) scales the second summer. These scales yield a score of "motor age," based on gross and fine motor performance. They also yield a score of "mental age," based on social behavior, language development, and behavior in response to test objects.

Innate Differences

Zinacanteco babies were born with physical and behavioral qualities that set

them apart from Euro-American infants in the United States (Brazelton et al. 1969; Brazelton 1972) or African neonates (Keefer et al. 1982). Physically, they were small, averaging five pounds in weight and eighteen inches in length at birth.

Assessed with the Brazelton Neonatal Behavioral Assessment Scale, Zinacanteco newborns were characterized by slow, liquid movements of arms and legs, low-keyed startles and reflex behavior interspersed with long periods of alertness. The delicate motor activity supported their sensory alertness. For long periods (six to eight minutes at a time) they watched, listened, and attended to auditory and visual stimuli without a break in attention. In Caucasian newborns in the United States, after three minutes of continuous attention, the state of attention is broken by excited motor activity or startles. Compared with Caucasian and African newborns, the Zinacanteco babies were significantly different in the quality of their motor behavior and the prolonged states of attention and of autonomic stability (Lester and Brazelton 1982).

In addition to maintaining quiet, alert states for long periods, with slow, smooth transitions from one state to another, they manifest none of the deep sleep, intense crying, or intense sucking states observed in the United States. The Zinacanteco babies were both less excitable (e.g., less irritable, with fewer spontaneous startles) and more consolable at birth. The apparent smooth control of state and motor behavior in Zinacanteco infants seemed to be of a higher order, facilitating the more developed sensory responses (visual and auditory). Their quiet motor behavior enhanced the prolonged period of attentiveness. The Zinacanteco babies habituated faster to a repeated stimulus from birth through the second day of life; habituation is considered a good measure of infant information processing/learning (Bornstein and Sigman 1984).

The Roles of Nature and Nurture

To what extent were the observed innate differences genetic; to what extent were they environmentally caused?

Nature. The argument for genetically caused behavioral differences in the newborn period is supported by 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 controlled state behavior, their smooth motor movements, and their prolonged attention to sensory stimuli (Brazelton et al. 1969; Freedman and Freedman 1969; Freedman 1979). While the Chinese-American sample shared most environmental features with the Euro-American sample, the behavior of the newborns differed in the two groups. On the other hand, Zinacantecos, Navajos, Chinese-Americans, and Goto Islanders, sharing almost nothing in the physical and cultural environment, did share a common pattern of newborn behavior. Given the absence of environmental commonality, the common behavior must, logically, have a 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); Maya Indians also have Asian roots.

Prenatal Environment. The beauty of studying babies at birth is that the extrauterine cultural environment has not yet had a chance to exert its influence. It is still possible, however, that prenatal environment has had its effects. There are three logical candidates for *prenatal* environmental factors: subclinical malnutrition, high altitude, and movement of the pregnant mother.

The first seems unlikely but cannot be entirely excluded. The general Zinacanteco diet is based on two complementary vegetable proteins, corn and beans (Lappe 1971), supplemented with small quantities of eggs, meat, greens, and fruit (Vogt 1969b). Emphasis is placed on the pregnant mother's diet to ensure that she have a good baby (Chávez et al. 1974). The Zinacanteco infant emerges from a mother who, during pregnancy, has been given a special high protein diet, consisting of what Zinacantecos consider "warm" foods, such as extra meat, eggs, and beans (Ansuetz 1966). This diet seems adequate to maintain caloric and iron requirements of the fetus. Their babies at birth do not appear stressed or IUGR (intrauterine growth retarded) (Als et al. 1976).

The Zinacantecos took a very practical approach to pregnancy and childbirth (Ansuetz 1966) and, over the years, have, without modern medicine, evolved practices that enhance the survival and fitness of their babies. Zinacanteco babies, in spite of their small size, showed none of the signs of being underhydrated, undernourished, or behaviorally stressed, which we have noted in other groups of babies around the world (Brazelton et al. 1976).

The possibility remains that high rates of intestinal infection adversely affected Zinacanteco mothers' ability to absorb food and that their babies were, in turn, affected. However, this hypothesis is inconsistent with the fact that Zinacanteco newborns shared behavioral patterns with middle-class Chinese-American newborns born in Kaiser hospital (Freedman and Freedman 1969), a group whose mothers would be expected to have excellent nutritional status and extremely low rates of intestinal infection.

The second environmental factor, high altitude (approximately 5500 to 8000 ft), could account for a portion of one of the observed differences—the difference in movement patterns. Babies born at a high altitude (e.g., Denver at 5000 ft) can show slow liquid movements of the same type, but not as extreme as the Zinacanteco newborns. These babies have polycythemia, slower responses to autonomic demands because of relative hypoxia (Lubchenco 1970). Given, however, that the same basic motor movements are found in newborns born at a low altitude (e.g., the Goto Islands in Japan), an environmental factor (altitude) would not seem sufficient to account for the newborn behavior pattern. Nevertheless, the high altitude, with its attendant polycythemia, could serve to reinforce the behavior pattern.

The third prenatal environmental factor is the shaping of intrauterine behavior by the mother's movements and reactions to her own environment. The specific action of this factor is the most speculative, although current research indicates that prenatal behavior is responsive to environmental stimuli. One possibility is

that intrauterine shaping enhanced genetically programmed behavioral patterns. For example, the controlled movement patterns of the Zinacanteco mother (Haviland 1978) and the quiet, rhythmic environment provided as she ground corn for tortillas or wove could have added to genetic influences in influencing the baby toward quiet, motor patterns.

Very likely, a number of factors worked together. The influence of relative hypoxia at this altitude, along with the nutritional effects of infection and the effects of constant, regular motor activity by the pregnant female, may have intensified the slow, liquid movements of neonates. This fluidity, lack of interfering motor activity, and well-regulated state and autonomic control, then, lent a potent background for what appeared to be auditory and visual competence in the immediate neonatal period.

Postnatal Environment. This apparent sensory competence may have depended on a lack of interference from the baby's own motor activity, coupled with a quiet environment immediately after delivery. The innate behavior of the neonate must be a powerful shaper of the nurturing environment provided by its parents.

The immediate perinatal experience—no drugs, no interference with the natural course of labor and delivery, emotional support for the mother, emphasis on subdued participation of the mother in the delivery—was then reflected in a similar experience for the newborn. The newborn was left undressed for a period. Even though he or she had a blanket at his or her back and was in front of an open fire, this would have been a highly stressful period, from an autonomic point of view, for a Euro-American baby. However, the Zinacanteco baby managed the necessary temperature control and was then placed in a swaddled, face-covered position beside the mother.

Breast-feeding occurred an average of sixty to eighty times a day over the first year, in several time samples, with up to ninety times a day in early infancy (Brazelton et al. 1969). These figures, obtained in the formal home observation situation, probably represent a maximum. Under the pressure of visitors, breast-feeding was performed in response to any activity on the part of the infant, rather than to any more direct expression of hunger. In more relaxed circumstances, an active baby on the back would first elicit patting from the mother, then rhythmic movement. If these procedures failed to quiet the baby, the mother would then nurse (Leslie Haviland, personal communication, September, 1988). A baby was never allowed to cry from hunger nor to become too active.

The mother's frequent nursing, sometimes in response to any movement, sets up a model of immediate, contingent responsiveness to the baby's needs, even before they were expressed. The baby, carried in a sling on the mother's back throughout the day, was cradled, rocked, and frequently breast-fed—rather than allowed to cry or to become frustrated.

Zinacantecos believe that an infant nurses for comfort as much as for nourishment, and that it should nurse when it wants to, whether out of hunger, or because it is frightened or disturbed in any way. It is essential, then, that its mother be readily available to it at all times, or its distress will make it ill

(Haviland 1978:241).

The tendency of these babies to remain quiet and slow in reactivity was reinforced by their subsequent handling in infancy, based on Zinacanteco child care philosophy. The infants' role in shaping the environment's response to them was visible in their neonatal behavior, which, in turn, provided the basis for appropriate reactions from the environment to reinforce their characteristics.

The force of the extrauterine cultural and physical environment began to be felt as early as the second half of the first week of life. Zinacanteco babies enjoyed a relatively quiet and inactive start in life, when compared with babies born in the United States. This difference in level of physical activity increased in the first week. Different care practices appeared to be responsible for this increase. Zinacanteco babies, in addition to starting life relatively quiet and inactive, were further constrained by being swaddled and carried horizontally on their mother's backs. In contrast, the typically more active Euro-American newborn, physically unrestricted in a crib, is left free to flail about. Patterns of nurture amplify those of nature.

Adaptation for Survival: Distinctive Newborn Behavior in its Cultural and Developmental Context

Clearly the example of motor movement in Zinacanteco newborns illustrates how the innate nature of the baby can be adapted to infant care in a particular culture. Even more important, it reveals how a fit between the nature of the baby and a cultural infant care practice functions to enhance survival in a particular niche of the physical environment. Note that swaddling is a successful adaptation to the cold. What if the Zinacanteco baby were very active and resisted swaddling? A newborn who kept kicking off its covers, as babies in the United States often do, would have small chance of survival in the cold climate of highland Chiapas, living in a house that was totally unheated during the night.

Anschuetz, in her field report, "To be Born in Zinacantán," speculated that "restrictive swaddling inhibits the child's motor development" (1966:20). This hypothesis was borne out by developmental testing (using the Bayley and the Knobloch-Pasamanick tests) (Brazelton et al. 1969; Brazelton 1972). While overall scores in Zinacantán generally lagged about one month behind norms established in the United States, the lag was consistently greater for motor skills than for mental skills.

Motor development was, nevertheless, normal. The close tactile and kinesthetic stimulation from being carried all day on the mother's back may have served as the necessary sensory input or fuel for the developmental program to proceed. Although not obvious to the casual observer, babies did a lot of leg stretching in the sling (Leslie Haviland, personal communication, September, 1988). Most important, the inborn program for motor development must have driven the baby on, given much less practice and what we think of as direct reinforcement from the environment. Although mothers did not encourage motor activity, they responded positively to the baby's need for it when his or

her motor program reached a certain stage of development. For example, at four or five months, Zinacanteco babies would no longer tolerate being carried in a horizontal position and covered on their mothers' backs; mothers responded to the older babies' frustration by letting them sit up with their heads uncovered in the sling carrier.

More important than the slight advance of infants in the United States in the area of motor development is the adaptive significance of the developmental difference. LeVine (1977) has noted that the survival of the infant is an overriding cultural value in societies in which there is a high infant mortality rate. In such societies (of which Zinacantán is one), survival overrides the goal of optimizing development. Surviving the cold is more important than speeding up motor development. Hence, what we might consider a deficit from our point of view becomes a necessity in the ecological niche of another society (Harkness and Super 1982).

Indeed, Zinacantecos did not seem interested in "optimizing" motor development. Based on an intensive study of ten Zinacanteco families, Francesca Cancian reported that, "For babies, as for older children, there was little pressure from adults to master basic skills, and little pride on the part of parents over the speed with which their children learn to walk or talk" (1963:60).

Going one step further, Leslie Haviland's observations indicate that, far from being neutral, Zinacantecos were actually negative about early walking and that this attitude was based on very real risks in early walking. Sophie Haviland walked at nine months of age; 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 was also considered disruptive to others—as when Sophie would stagger into somebody's weaving. Zinacantecos were horrified at the problems that Sophie caused by her too-early development of walking and 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 (Leslie Haviland, personal communication, September, 1988).

Breaking cultural norms often reveals most dramatically what the norms are. In the case of motor development, reactions to Sophie's deviation from the normal walking age made it clear that Zinacantecos do not merely tolerate but actually value late walking. Even more important from a theoretical perspective is the fact that this norm is much more adaptive for survival in the Zinacanteco environment than our norm of maximizing motor development would be.

Developmental Similarities

Given Zinacanteco attitudes and the fact that the tests were extremely foreign

to them (e.g., Zinacanteco infants were never placed in the prone position required for certain motor items on the tests nor generally given objects to play with), it is interesting that Zinacanteco babies lagged *only* one month behind American norms in developmental testing. Even more important, they passed developmental milestones in the same sequence as do babies in the United States. This common sequence is theoretically important: most likely it reflects the human genetic program for infant development.

Adaptation to Cultural Continuity versus Innovation and Individual Initiative

For Zinacantecos at the period of study, a key concept was *batz'i*, the true way, synonymous with the Zinacanteco way. In order to maintain the "true way" in the face of influences from modernization and the surrounding *ladino* community, it had to be transmitted to the next generation in every area of life—work roles, familial roles, and religious roles. We came to realize as a result of our developmental research that the culture not only transmitted the *content* of socialization, it also transmitted *processes* of learning and teaching by which cultural continuity was maximized and cultural innovation was minimized. The first such process to appear in infancy was imitation of a model for learning.

All babies imitate. However, the innate foundation of *special* skill in imitating a model lies in the Zinacanteco newborn's unusual attentiveness and sensitivity to visual and auditory stimuli: the first step in imitating a model is to observe and comprehend it. Indeed, an excellent ability to imitate surfaced in the developmental testing in the first year of life (Brazelton et al. 1969). Repeatedly, infants watched us carefully as we demonstrated the use of test objects, then imitated each movement we had made to score a success on the test, subsequently dropping the object without any of the exploration or experimental play we would have seen in babies from the United States. In addition, novel objects met with impassive faces in tested children and parents alike.

While exploration, experimentation, and novelty are highly valued in our culture, they may constitute a danger to a culture that wants to transmit a replication of itself to the next generation. Possible outcomes of exploration, experimentation, and attraction to novelty are innovation and cultural change. In similar fashion, individual initiative, a highly valued quality to us, also brings the danger that the individual will use this initiative to inaugurate new ways that deviate from the traditions of the group. More valued should be the ability to respond to the initiative of others, especially those older than oneself. The initial encouragement of this quality could be seen in the Zinacanteco infant's first interaction, breast-feeding.

Breast-feeding was an immediate response to any activity on the part of the infant, not just hunger. It therefore served a general quieting function, perhaps dampening self-initiated behavior. In addition, the infant's need to suck or feed was satisfied instantly—before he or she could build up to feel the importance

of a need, make a demand, and then find it gratified. We speculate that feeding therefore did not contribute to the framework for self-motivated demand, frustration, and then gratification—a cycle which must be important in fueling a model for self-initiated independence (Brazelton 1972).

To continue our speculative interpretation of nursing, we may here have the ontogenetic roots of what, from the point of view of our own culture, is a discouragement of the child's individual initiative. From the Zinacanteco point of view, however, frequent nursing may in fact lay the groundwork for a view that the individual receives what he or she needs from *responding to others* rather than from *taking the initiative* to make others respond. This way of thinking is consonant with the ideal of fitting into a communal society.

Perhaps even more important from the Zinacanteco point of view is the fact that, in the nursing situation, the *younger* person is responding to the initiative of the *older*. An all pervasive concept in Zinacanteco culture is the contrast between *bankilal* and *itz'inal*, older and younger brother.⁴ This senior/junior principle serves as a model for relative age or time as the basis for rank (Vogt 1969b). Applied to social relations and interaction in the family, the basic rule is that older people have authority over and command respect from younger people (Cancian 1963).

Under this analysis, Zinacanteco practices organized around nursing could form the roots of socialization into a society that values intact transmission of culture from the older generation to the younger. As we shall see, emphasizing the *responsiveness* rather than the *initiative* of the younger member of a dyad in social interactions in early infancy continued into childhood, when "good" children were assessed by their obedience to their parents (Blanco and Chodorow 1964), and commands were a dominant strategy for teaching new skills (Childs and Greenfield 1980; Greenfield 1984).

COGNITIVE DEVELOPMENT AND INFORMAL INSTRUCTION FROM ONE TO FIVE

Strategies for Nesting Cups

One aspect of the lack of experimentation with objects noted in the developmental testing was lack of investment in objects. This quality continued to be observed in Zinacanteco children carrying out a manipulative task (nesting cups inside each other) at one year of age (see procedural details in Appendix A). A one-year-old Zinacanteco child was able to let go of a nesting cup after placing it inside a second cup. An American child of the same age could not; the cup became part of his or her hand in a seemly egocentric fashion. The Zinacanteco behavior was more advanced in the sense of being less egocentric, less centered on the self as reference point; perhaps this is related to the greater other-centeredness of early interactions. At the same time, the dropping response cut off manipulation of the objects at an early stage of task development. These behaviors seen in testing and experimentation were also noted in home obser-

vation of babies in the first year of life (Brazelton et al. 1969; Brazelton 1972). In four hours, the modal number of times an infant played with a toy was zero; the maximum was seven.

The nesting cup study indicates that lack of object investment rather than early movement away from egocentrism explains the results. In this study, the older the Zinacanteco child, the more likely was he or she to utilize rather than let go of the first cup (see Table 1, Appendix A, for quantitative details). Our kinship concept results (to be described later) make it unlikely that egocentrism would increase with age. Therefore, increasing object investment remains as the only plausible factor. It seems that object investment developed later in a culture in which interaction with objects was deemphasized in the play of infants and children. A large (and therefore early) investment in objects and their manipulation is a functional necessity for socialization into a technological society such as ours. It is much less relevant, however, for a technologically simpler society such as Zinacantán.

Given the seeming lack of investment in the experimental materials, it is interesting that the basic developmental sequence of strategies used by Zinacanteco toddlers and children for combining the cups was identical to that found in the United States. We had identified three combinatorial rules that constituted a developmental sequence of grammarlike rules. The three rule-bound strategies—the grammar of action—are depicted in Figure 1. In the first phase (pretest) of the experiment, children played with the cups on their own during two trials, after seeing a demonstration of Strategy 3, the subassembly method, at the beginning of each trial. With Zinacanteco children of nine to fifteen months of age, we found that Strategy 1 was predominant, with a minority of children favoring Strategy 2. From twenty-one to thirty months, Strategy 2 was predominant, with a minority using Strategy 3. So far, both sequence and age norms are similar to those found in the United States. However, Zinacanteco children from thirty-five to seventy months of age, unlike their United States counterparts, did not progress to Strategy 3 on the pretest (see Table 2, Appendix A, for a quantitative analysis).

In the second phase of the experiment, we asked the mothers to teach their children how to nest the cups, using Strategy 3. In the third phase, an independent posttest following the teaching session, nine out of fourteen children in the oldest group (thirty-five to seventy months of age), who earlier had predominantly used Strategy 2, progressed to dominant use of Strategy 3. In four of the nine cases, practice alone (as assessed by performance in a third pretest trial) produced Strategy 3, the subassembly.

Though it is hard to compare age norms in the two cultures for Strategy 3, since some of the Zinacanteco children were older than the United States sample, the addition of practice and instruction actualized the latent third stage. The appearance of this sequence, in spite of the fact that the materials and task were totally foreign to Zinacanteco infants and their mothers, provides evidence for a transcultural and possibly universal development of grammars of manual action.

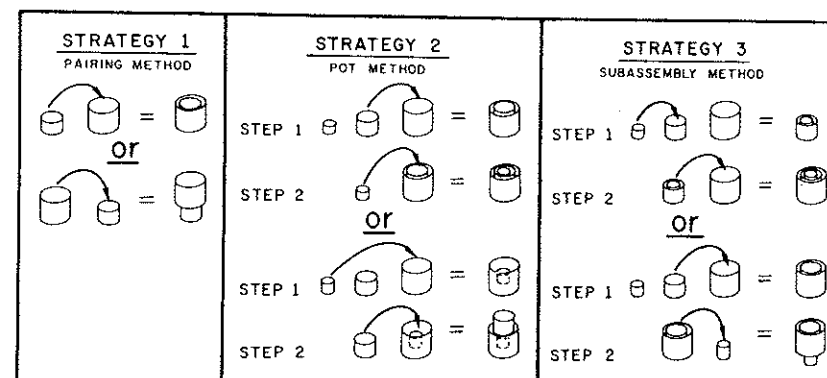


Figure 1. Strategies for combining seriated cups. In Strategies 1 and 2, a cup has a single role: it is either a stationary cup or a moving cup. In the most advanced strategy, Strategy 3, a cup or set of cups has a double role: it is first stationary and acted upon and then becomes a moving or acting cup. This dual role of a single element parallels the dual role of a grammatical element as both object and subject in an embedded sentence (e.g., "man" in "The man I love has a dog" or "I saw the man who lives there").

Maternal Teaching Strategies

The mothers' verbal and nonverbal teaching styles were also coded and characterized in the following ways.

Verbal comments were categorized as commands, statements, questions, or explanations, generally following the system used to characterize the verbal aspects of weaving instruction (Childs and Greenfield 1980). In line with the cultural importance of obedience from younger to older in Zinacanteco culture (see later section, "Commands in an Age-Ranked Society"), the overwhelming majority of maternal verbalizations were commands (see Table 3, Appendix A, for percentages).

The nonverbal styles were divided into three types originally identified by Kaye (1977) in a study of six-month-old babies being taught a sensorimotor problem-solving task by their mothers. *Shape* was an instructional style in which task simplification predominated. *Show* was an instructional style in which demonstration and pointing were dominant. *Shove* was a style in which the mother moved the child's hand for him or her.

Like the teaching style of the mothers studied by Kaye in the United States, the Zinacanteco mothers' teaching style was sensitive to the developmental level of the child being taught. (Because task performance was so related to age, it was hard to tell from these results alone if the mother's sensitivity was to the child's age or stage of task performance; the results of our study of weaving instruction make stage the likely factor.) Shaping, or task simplification,

predominated for the mothers of children using Strategy 1; it declined for each successive developmental level. Showing was most predominant for the mothers of children using Strategy 2; it declined somewhat for mothers of children initially using the most advanced strategy. Shoving did not predominate at any stage, but reached its height for children using Strategy 3 (see Table 4, Appendix A, for a quantitative analysis). Kaye (1977) had also found that shaping was used more by mothers in the United States whose babies had the poorest pretest performance. Having only two levels of task performance in his study, however, he did not find a differentiation of showing and shoving according to the child's developmental level.

Like Kaye (1977), we found that mothers often combined strategies and that the developmentally correlated strategy was not necessarily more successful. Nor did active teachers achieve more success than did passive ones. Success seemed more related to the child's age than to the mother's teaching. The role of maturationally based readiness is demonstrated by the fact that almost half of the oldest children who progressed from the pot to the subassembly strategy did so on the basis of a few practice trials, even before the mother began her instruction.

The fact that the Zinacanteco mothers showed the same type of developmental sensitivity as Euro-American mothers is striking, considering that this type of task and materials were so very foreign to the Zinacantecos and that a correspondence between mother's teaching style and child's developmental level was not reinforced in either country by more successful learning on the part of the child. These results suggest the hypothesis that the mother/teacher's sensitivity has some sort of built-in biological basis. In addition, there may be an innate foundation for the one difference that emerged between mothers in the United States and Zinacantán: Zinacanteco mothers were less often "shovers." This style difference seemed to reflect the innate Zinacanteco quality of low motoric assertiveness first displayed by newborns.

LATER COGNITIVE DEVELOPMENT AND LEARNING

Mirroring our findings with infant and toddler development, the striking result of our studies of later cognitive development was the appearance of the same sequences of development from age four to adolescence as one would expect in the United States or Europe. Whether the task was conceptual understanding or visual pattern representation, this finding was the same. In the area of conceptual understanding, we explored culturally central kinship concepts (Greenfield and Childs 1978) and the classification of culturally relevant flowers and culturally irrelevant rods (Greenfield 1974).

A Study of Kinship Concepts: Transcultural Patterns of Cognitive Development in Childhood and Adolescence

Our study was a developmental one, involving children and adolescents at three age levels: four and five, eight to ten, and thirteen to eighteen years old.

The procedure we used is presented in Appendix B.

We tested the effect of the structure of Zinacanteco kinship terminology as worked out in two componential analyses by Jane Collier (1969), as well as applying a system developed by Haviland and Clark (1974). None predicted our results. We also considered the impact of the Zinacanteco emphasis on age ranking, including the *bankilallitz'inal* distinction. This factor also failed to predict the order of acquisition or the errors of our three age groups of subjects. In sum, the developmental pattern could not be attributed to any factor specific to the Zinacanteco culture.

We found that the youngest children were able to list their sibling group as young as we tested them. Because Zinacanteco households do not normally have cousins or unrelated children living in them, we do not know if, at this point, the child has the relational concept of common parentage or the more absolute concept of members of an age group living in the same household. Common parentage seems more likely, as siblings in Zinacanteco households can sometimes be old enough to be members of the next generation.

The next stage was the acquisition of the ability to discriminate sibling terms that differentiate males from females. One possible reason for the early acquisition of these conceptual dimensions, siblingship, and sex, suggested by the theoretical analysis of Hirschfeld (n.d.), is that they could have an innate basis in the child's conceptual apparatus. Our ability to rule out culture-specific factors affecting the pattern of development provides evidence in favor of this speculation.

At the same time, terminological differentiation of the sibling group involved the developmental process of decentration (movement away from egocentrism), a key element in Piagetian theory. This development is shown in Figure 2, where it can be seen that the children are able to answer ego-centered questions (e.g., "What is the name of your older sister?") before other-centered questions (e.g., asking the child to name his older brother's older sister), and that the ability to answer other-centered questions involving a reversal of perspective ("As for your younger brother Petul, what is the name of his older brother?" Answer: "Me.") develops last of all.

This developmental sequence is exactly that predicted by Piagetian theory. Having ruled out culture-specific factors as a causal influence, we may conclude that a genetically based program for human development, operating across a wide range of genetic and cultural variability, is responsible for this common pattern of cognitive development.

Although our questions were adapted to Zinacantán and differed in form from those of Piaget (1928), the ages for the final decentered stage agree with Piaget's age norms in Switzerland. A common rate, as well as a common sequence of development, indicates equivalent stimulation for this domain of knowledge in the two cultures. Given that Zinacanteco children seemed to master a more complex system of sibling terms at the same age as children in the United States, it is even possible that Zinacanteco culture was providing *greater* stimulation for the comprehension of kinship terms. This speculation fits with the greater

importance of sibling relations in Zinacantán as compared with the United States.

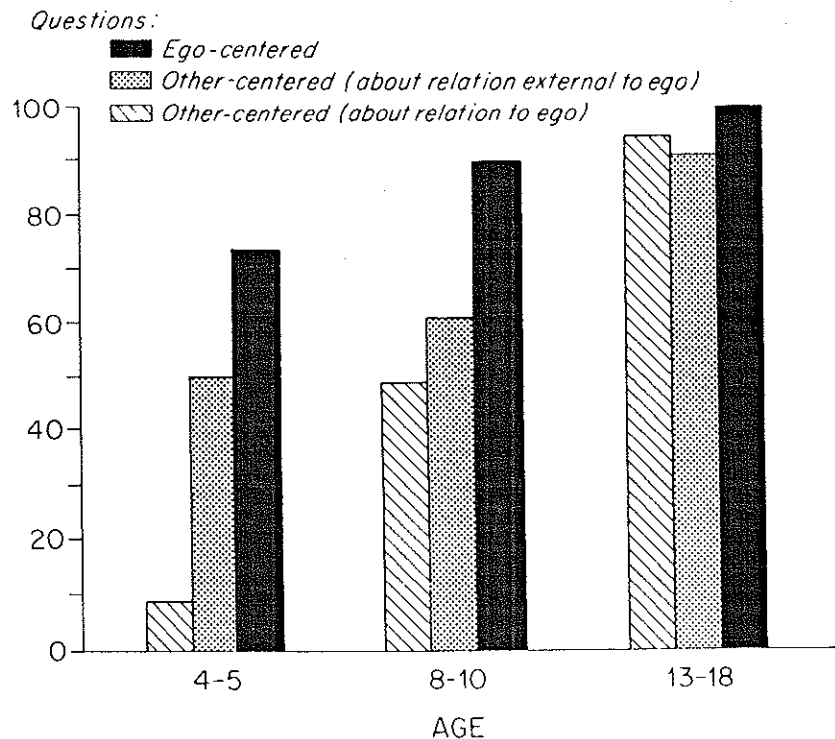


Figure 2. Percentage of different types of question answered correctly at different ages.

A Study of Object Classification: Transcultural Patterns and Cultural Constraints

The same general agreement with stages and ages in the United States and Europe appeared in the second study of conceptual understanding, the object classification study. The stimuli are shown in Figure 3. A child might first be asked to tie the flowers into a red bouquet and a white bouquet. Then the bouquets were untied, and he or she had to sort by species. The last step was to make bouquets by length. In the second stage of the experiment, the child had to sort and re-sort the rods by color, circumference, and length. Different attribute orders were used for different children. Our subjects fell into the same three age groups as in the kinship study.

According to a Piagetian analysis, one would expect the ability to re-sort, an

instance of two-way classification, to become fully developed in the second age group, eight-to-ten-year-olds; this age group did, in fact, show this ability, thus conforming to a Piagetian description of concrete operational thought.

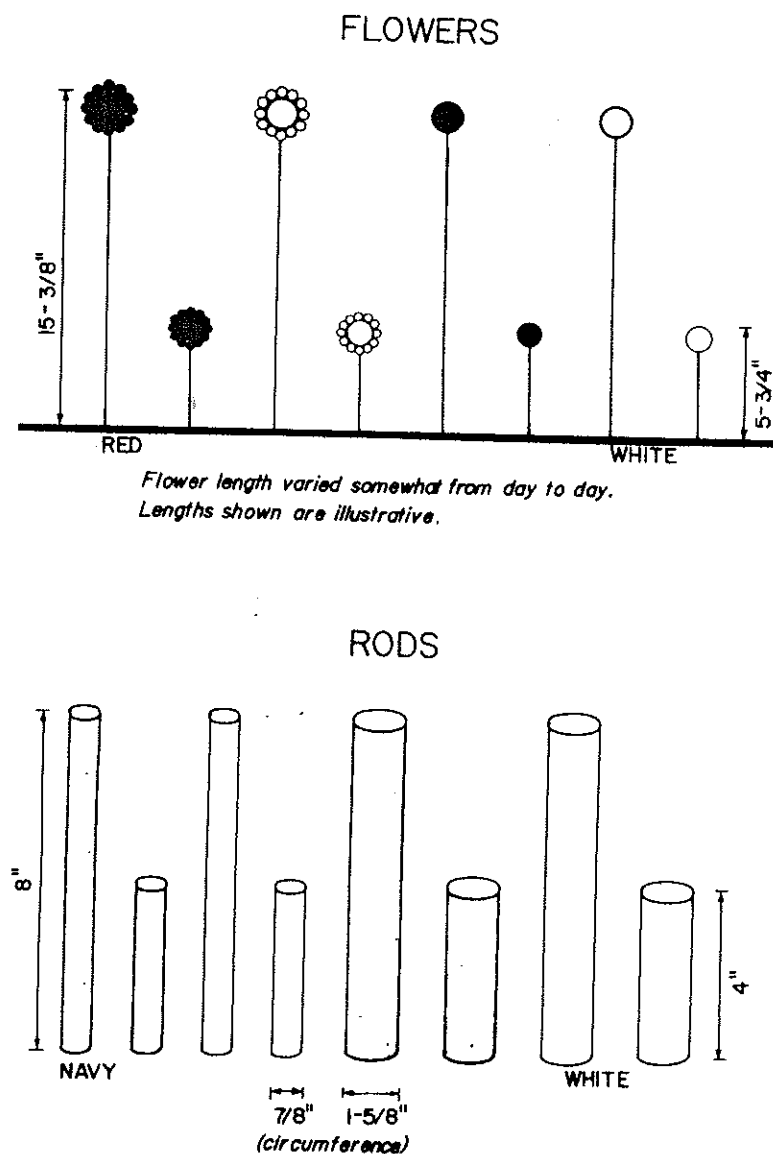


Figure 3. Flower and rod stimuli for object classification study.

From Piaget's scheme of ages and stages, one would have also predicted that the youngest group, age four and five, would be able to sort but not re-sort. With the rods, this prediction was confirmed: a majority of the four- and five-year-olds were able to sort, while only a third of the group could re-sort the rods. Sorting performance was not as good with the culturally more familiar flowers: less than half the youngest children could do the first sort, although, again, a third could also re-sort.

Neither the familiarity of bouquets of flowers nor experience as a flower seller helped performance. In fact, for the youngest children, performance was best with the unfamiliar, but perceptually simpler rods. Over the sample as a whole, re-sorting of the flowers seemed further hindered by the fact that it made no cultural sense to take apart perfectly "good" bouquets (sorted by species or length) to make "inferior" ones (sorted by color). Logical manipulation by the experimenters led Zinacanteco subjects far away indeed from the *batz'i* way. Miyamoto (1969) had found a parallel cultural constraint in his developmental study of concept development.

Once again, the general sequence of development was predicted by a universalistic theory, that of Piaget. Similarly, the rate in which this sequence progressed indicated fairly equivalent environmental stimulation in general, with one exception: Zinacanteco emphasis on the *batz'i* way was in conflict with and therefore hindered unlimited reclassification of the familiar flower stimuli.

Pattern Representation: Effects of Weaving Experience and Cognitive Development

In a visual pattern continuation task, we asked schooled and unschooled Zinacanteco children from four to eighteen years of age to use sticks in a frame to represent striped patterns. We found that pattern representation passed through stages of increasing differentiation and hierarchical integration, as posited by Werner's (1948) universalistic theory of development (Greenfield and Childs 1977).

Against this background of similarity, there again appeared a specific cultural effect related to our observations of Zinacanteco infants. One of our pattern continuation tasks could be treated by going beyond the given information. In this pattern, the child was shown a series of red and white stripes in the following configuration: 1 red, 1 white; 2 reds, 2 whites; 3 reds, 3 whites; 4 reds, 4 whites—a so-called growing pattern (Figure 4). Of the Zinacanteco children who did not go to school, no child at any age could complete this pattern by making it grow (Progression strategy, Figure 4)—the oldest unschooled children succeeded only in repeating it directly or in mirror image; these are valid, but more imitative, representations. In the Zinacanteco culture there was but one clearly prescribed way to do every task. Our task was most often treated the Zinacanteco way: the growing pattern was copied stick-by-stick. We see this behavior as fitting with the observations of Zinacanteco infants. They showed good imitative ability, but lack of motivation to go beyond the model and experiment with objects.

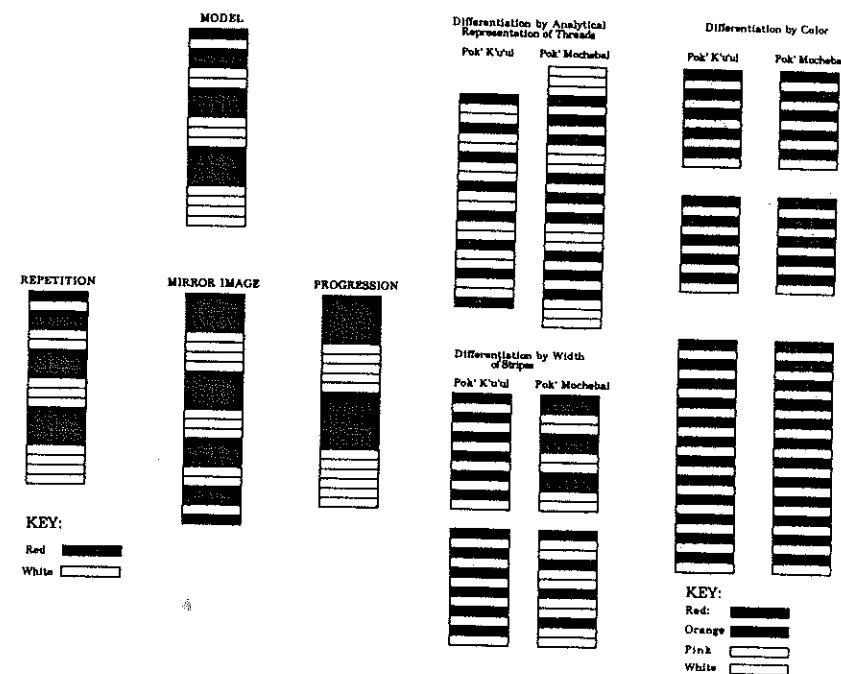


Figure 4. Model for growing pattern and three possible continuations.

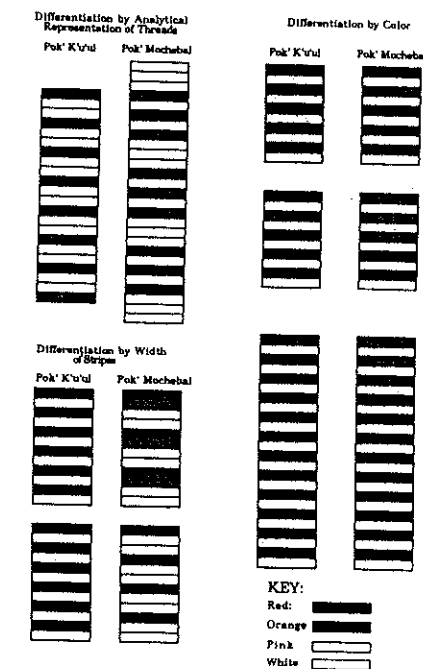


Figure 5. Representations of two familiar woven patterns: *pok' k'u'ul* and *pok' mochebal*. Upper left: differentiation by analytical representation of threads, maintaining pattern configuration. Lower left: differentiation by width of stripes. Right: differentiation by color. (In each pair, the *pok' k'u'ul* representation appears on the left, the *pok' mochebal* representation on the right.)

We also used the pattern representation task to look for effects of an out-of-school learning experience—learning to weave—on cognitive processes. Among the older groups of subjects, some knew how to weave; others, being male, did not. Some of the males had, however, been to school. First the subjects were asked to represent the red-and-white striped patterns of two familiar woven garments—the *pok' mochebal*, worn by all females, and the *pok' k'u'ul*, worn by all males—by using wooden sticks in a frame to construct the designs.

There were interesting differences between the female weavers and the male nonweavers. A substantial proportion of the girls used the sticks accurately to represent the colors and configurations of the two patterns as they are actually constructed with threads (see Figure 5, upper left). In contrast, the boys generally differentiated the two patterns by using the sticks to convey the visual

impression created by the garments at a distance, violating thread configurations and even colors in the process (see Figure 5, left lower and right). In the case of each group, the representation was closely related to the function the patterns served in the real world. Girls who are responsible for weaving the patterns must analyze their construction. Boys, who merely wear and observe the patterns in the clothing of others, are more concerned with a general overall impression. Cultural functions, differentiated by sex, influenced representation of familiar woven patterns.

The question of whether pattern skills would transfer from weaving to a new context was raised in our research. Subjects were asked to continue novel patterns, culminating in the growing pattern described earlier. Weaving experience was a detriment: nonweaving boys performed significantly better. For the girls, who were directly involved in the weaving patterns and had less contact with the outside, modern world, perhaps deviation from the "true way" was simply out of bounds. In our culture, we put a very positive value on transfer of skills to new situations. Transfer is a learning process that involves novelty and can lead to innovation. From the Zinacanteco point of view, therefore, transfer must have had a negative value.

The Teaching and Learning of Weaving: An Example of Informal Education

In 1970 we made a video study of Zinacanteco girls learning to weave on back-strap looms (Childs and Greenfield 1980; Greenfield 1984).

Observation and Modeling. Learning by observation continued to be extremely important long after infancy in learning adult skills central to the culture. One obvious fact was that girls of eight to ten years of age, sitting down at a back-strap loom to weave their first piece of cloth, already knew a tremendous amount about weaving, although they had not yet taken part in the process. Leslie Haviland notes that, "The girl's mother or an older sister will have been watched carefully for some months by the young girl" (1978:215).

While the novice was weaving, an adult (most frequently the mother) intervened at difficult parts, often taking over from the beginning learner. In so doing, the adult simultaneously provided a model and got the job done with maximum efficiency. Thus, observation of another person continued to be critical, even at an older age. Like Zinacanteco newborns, the weaving learners are extremely attentive: first-time weavers watched more than they wove, and they attended to the model eighty-four percent of the time. Observation rather than experimentation constituted the crucial learning technique.

The learners also listened more than they spoke. With the exception of the one schooled girl in the sample, the rate of verbalization was very low. Once again, initiation of an interaction by a younger person was not part of Zinacanteco culture; as in nursing, the younger person's role was to respond.

As the weaver became more experienced, the role of modeling and imitation decreased. The teacher gradually withdrew from the active task role, and the

learner increasingly participated, rather than merely watching the teacher. At the next stage there was an increase in cooperative activity with the teacher, as well as in independent weaving. Finally, somewhere around age thirteen to fifteen, and after many completed pieces of cloth, the teacher withdrew completely, and the experienced weaver was on her own. At this point, the Zinacanteco female had "graduated" from her informal education. As an experienced weaver, she now possessed a skill that was said to contribute to her marriageability (Trosper 1967).

Shaping. In harmony with the strategy used with children six or seven years younger in the nesting cup experiment, "shaping," or task simplification, was used with the most novice weavers: they were first given small items requiring less strength to weave. This conclusion is supported by Leslie Haviland's (1978) observation in the same hamlet of Nabenchauk that girls generally started by weaving small bags.

Scaffolding: The Match Between Teacher Techniques and Learner Needs. The teacher's sensitive adjustment of teaching techniques to skill level and task difficulty was evident in other responses as well. In general outline and even in some specific features, it is reminiscent of Zinacanteco mothers' adjustment of teaching techniques to their children's skill level in the nesting cups task. Because girls start to weave at a variety of ages, our results made it clear that the adjustment was based on learner skill level, not chronological age.

Commands in an Age-Ranked Society. Commands played an important role in the informal education of Zinacanteco children. "A Zinacanteco parent's highest praise of his child is 'He obeys well, he works well'" (Blanco and Chodorow 1964). A younger person is obliged to carry out the commands of an older one (Cancian 1963). Cancian's comparative study in Zinacantán and Cambridge showed that, in Zinacantán, mothers commanded children more frequently than in the United States, while Zinacanteco children gave direction to mothers less often than children in the United States (Cancian 1971a). This comparative finding shows how the hierarchical structure of Zinacanteco society, with its emphasis on the senior/junior principle, was reflected in the very nature of parent-child interaction.

Normally commands are considered in terms of their power connotations; in Zinacantán their role in informal instruction was also important. As we saw in the nesting cup situation, commands dominated mothers' verbal strategies for teaching very young children how to nest cups. Similarly, commands dominated the verbalization from teacher to first-time novice weaver, constituting ninety-one percent of the teacher's verbal output.

Commands, however, declined dramatically in proportion to the learner's experience. By the time a learner had already woven two to four pieces of cloth, commands constituted only about half of the teacher's output. Statements had become quite important, though explanations continued to be virtually nonexistent. Indeed, it was the paucity of explanations that led Leslie Haviland to conclude that "rarely does anyone verbalize the method" (Haviland 1978:215, personal communication, October, 1988).

Because a major implication of the junior-senior principle in the Zinacanteco family is the obligation of the younger person to obey the older, the weaving "teacher" had the weight of the culture behind her commands. The specialized use of commands as a teaching technique for novices comes out when we compare our data with that of Francesca Cancian (1963), who studied family interaction in Zinacantán across a wide range of household situations. In her data the proportion of commands uttered from mother to child was much lower than for our weavers of comparable age, indicating the specialized function of commands in helping novices to accomplish a new task.

Obedied commands not only teach, they also get the task done. As Greenfield and Lave (1982) and Wertsch, Minick, and Arns (1984) have pointed out, informal education often occurs as a byproduct of task accomplishment. This is very much the case for Zinacanteco weaving education (Haviland 1978, personal communication, October, 1988).

If the *bankilal-it'inal* or senior/junior principle operates as precisely as Vogt (1969b) claims, then we could predict that the tendency to carry out commands would be a function of *how* junior the "commandee" was to the "commander." We reanalyzed some of Francesca Cancian's (1963) thesis data to test out this hypothesis, looking at the ratio of obedience to disobedience. As predicted, children were most obedient to their grandmother, next most obedient to their mother, and least obedient to their older sister: as age span between junior and senior increased, so did obedience. However, at worst, in the case of the older sister, children still obeyed almost twice as often as they disobeyed.

Development intervened to modify this relationship between obedience and junior-senior distance, however. Although the distance is less for an older girl than for a younger girl vis-à-vis her mother, obedience was more, not less, frequent. With development, a more collaborative and responsible relationship seemed to develop. The number of commands went down in this relationship (Cancian 1963); at the same time, the older daughter did more self-initiated chores (Blanco and Chodorow 1964). Our weaving study also showed an increase in initiation as the learner became older and more experienced. Completing this picture of a relation that becomes increasingly collaborative with age, we found *no* instance in Francesca Cancian's (1963) data in which the mother failed to obey directions from the grandmother, her own mother.

Reinforcement. We explored the use of verbal reinforcement in the teaching of weaving. Blanco and Chodorow (1964) had reported very little verbal reinforcement for household chores, with very occasional rewards. In our weaving data, there was also very occasional verbal reinforcement; almost all of it was negative (e.g., "You don't know how."). More frequently, reinforcement took the form of saying something to another person within earshot of the learner. Again, this was almost always negative. Despite the disagreement with Blanco and Chodorow's findings in this respect, the dominance of negative rather than positive reinforcement, which we found in weaving instruction, accorded well with the broader cultural pattern of genres of ritualized insults identified by Bricker (1973b).

We also wonder if there might not be a connection between this negative evaluative approach to teaching and the self-disparagement that occurs in Zinacanteco ritual prayers, for example:

Grant pardon to my lowly back,
Grant pardon to my humble side,
To me, who am Thy lowly dog,
To me, who am Thy humble pig,
To me, Thy dunce,
To me, Thy fool,

[Dedication of a new house; Laughlin 1980:226].

Perhaps the negative evaluation from others during childhood becomes incorporated into a negative self-image in adulthood. In the absence of psychology, religion may then provide a ritualized way of dealing with a culturally induced psychological problem.

Failure-Free Learning, Observation/Imitation, and the Maintenance of Tradition. Perhaps the most striking feature of the ensemble of weaving instruction was that it constituted failure-free and relatively errorless learning. Most likely because of observing models of weaving expertise at earlier points in time, the novice weaver already looked very proficient when she sat down to weave for the very first time, and the teacher always intervened when the going got tough, thus preventing errors. This method contrasted with the trial-and-error methods of learning weaving observed in Cambridge, Massachusetts (by Greenfield), Akwete, Nigeria (by Lisa Aronson), and in highland Guatemala (by Maria and James Loucky).

In seeming contrast with our formal study, Leslie Haviland describes the role of the instructor as being "to correct mistakes and to untangle problems as they occur" (1978:215). During our formal observations, potential mistakes were most often prevented before they became problems. Therefore, we saw error prevention on the part of the weaving "teachers," rather than the error correction mentioned by Haviland (1978). However, the difference may be more apparent than real. Haviland (personal communication, October, 1988) noted that, unlike our more formal videotaped observations, a weaving learner did not always have her mother or other "teacher" available to watch her. Hence, the presence of our camera probably elicited more intense watchfulness and more successful error prevention by the "teachers" than would take place in everyday life. Nonetheless, the process of error prevention through "teacher" intervention was also observed by Haviland and should, at the very least, represent a cultural ideal.

Haviland (1978) also noted that the small items woven by beginners were full of mistakes. Weaving "teachers," under the constraints of other household work in everyday life, prevented failure but allowed small errors that affected the looks but not the function of the woven items. Still, these small mistakes were a far cry from the full-scale trial-and-error experimentation observed in the Cambridge back-strap loom weaving class.

In a trial-and-error approach, it is always possible that the learner will discover new patterns or methods. For the Zinacantecos, however, there was but one correct method, the *batz'i* or true one, and there were only three patterns woven for clothing, one worn by all men and the other two worn by all women. (The top left of Figure 5 gives a good sense of the two major patterns, the *pok' k'u'ul*, for men, and the *pok' mochebal*, for women.) Learning by observing and imitating a model was a method for exact transmission of these culturally defined patterns. These patterns then constituted the foundation of the culturally defined or *batz'i* manner of dressing. The power of this norm is revealed in the following anecdote: Once we asked a Zinacanteco girl why some Zinacanteco people who passed by were dressed in different clothing. The reply was, "they don't know how to dress."

Conformity and Individuality. Despite the Zinacanteco emphasis on conformity to tradition, there was still room for individuality. As in our culture, individual personality was expressed within culturally defined limits; the limits were simply narrower in Zinacantán. In the arena of weaving and textiles, for example, each of the standard woven patterns had variants within its general configuration, and woven clothing was trimmed with embroidery defined as to location but freely variable as to pattern. Leslie Haviland writes: "Far more than any other activity weaving gives expression to a Zinacanteco woman's personality. Even if, to the untutored eye, the degree of variation in Zinacanteco textiles is so minute as to speak more loudly of the narrow conventions of style within which it is contained than of the individuality of which it is the manifestation, it remains a clear signal of personality to the Zinacanteco beholder" (1978:207).

Contrast with "the American Way." Our analysis of the implicit differences between instruction and learning in Zinacantán and the United States was dramatically validated by Marta Turok's (1972) description of the conflicting cultural assumptions that were revealed when she, a Harvard student, 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 1972:1-2].

This description affirms the contrasting role of observation and active ex-

perimentation in the two cultures. It also reveals that relatively errorless learning did not merely "happen"; it was expected. Finally, Turok's description confirms the tendency toward negative rather than positive reinforcement in informal instruction.

THE INFLUENCE OF SCHOOLING AND GENDER

In all of the studies of cognitive development in middle childhood and adolescence, there were samples of schooled as well as unschooled subjects. In the study of learning to weave, there was one schoolgirl in the sample. What difference, if any, did schooling make? First, it is necessary to state that all schooling occurs in Spanish, a language that is not spoken at home by the children. Second, Spanish introduces reading and writing into an otherwise oral culture.

On the basis of Greenfield's (1966, 1972a; Greenfield and Bruner 1969; Greenfield et al. 1966) previous research in Senegal, it was expected that schooling would have a large and positive impact on cognitive development as measured in an experimental situation. However, this was not the case. For example, there were no differences between schooled and unschooled adolescents in the development of skills in classifying familiar and unfamiliar objects. In the development of kinship concepts, the only difference favored unschooled children: unschooled eight-to-ten-year-olds were, more often than schooled, able to answer kinship questions in which the subject had to view a kin relation to self from the perspective of another person. As in object classification, schooling made no difference at all in the development of pattern representation.

Why should schooling not have been an advantage to overall cognitive development, as measured by our tasks? There are a number of possibilities, some lying in the tasks, some in the nature of schooling, others in the Zinacanteco concept of intelligence, and still others in the Zinacanteco nature itself.

As for the tasks, all the major cognitive tasks given to school-age subjects were highly structured, unambiguous, and left little room for alternative cultural interpretations. In addition, a number of the major tasks—kinship, flower sorting, representations of woven patterns—were based on Zinacanteco culture. Indeed, traditional Zinacanteco education was *more* effective than school-based education in developing decentered comprehension of sibling relations, a culturally central domain for Zinacantecos.

Only one task—classifying rods—was culturally irrelevant. Yet among the Baole of the Ivory Coast, Dasen (1984) found that the logical ability involved in such tasks is correlated with parental judgments of a child's respect and obedience at home, qualities also highly valued by the Zinacantecos. Therefore, even this seemingly irrelevant task may somehow have tapped traits considered culturally desirable for Zinacanteco children.

As for the nature of schooling, the local schools went through third grade only and were staffed by non-Tzotzil speakers, many of whom had not even completed high-school level teacher training (Trosper 1967). While differences in

Senegal between school and unschooled children appeared as early as the first grade, the predominantly Wolof children (also from an oral culture) were taught primarily by African teachers, bilingual in Wolof and French. Finally, among the Zinacanteco adolescent subjects, many were undoubtedly no longer in school and making little use of their school learning (Trosper 1967).

As for definitions of intelligence, all Zinacantecos agreed that school makes a child intelligent (Trosper 1967). Although far from definitive, this agreement could mean that the indigenous definition of intelligence was in harmony with what was taught in school: this is not the case in many African cultures (e.g., Wober 1974; Dasen 1984). For example, among the Baole, some people saw school intelligence as distinct or in conflict with the indigenous concept of intelligence (Dasen 1984; Dasen et al. 1985). Therefore, it could be that, unlike several African societies, schools in Zinacantán were developing qualities of mind that were already valued and encouraged in the Zinacantecos' informal education. This point must, however, remain speculative until such time as someone investigates the Zinacanteco, as well as the Wolof, concept of intelligence.

The final factor, Zinacanteco nature itself, relates to the excellent attentional qualities shown by Zinacanteco newborns. Insofar as infant visual attention (especially habituation) predicts later cognitive development (Bornstein and Sigman 1984), perhaps the "head start" provided by the Zinacantecos' innate attentional skills, in combination with their traditional informal education, suffices to bring children to the level of cognitive development expected in our culture, overshadowing any possible effects of relatively poor quality formal education.

Despite the similarities in the major patterns and rates of cognitive development between schooled and unschooled children in Zinacantán, schooling did, nevertheless, produce some differences. The differences were particularly interesting because they seemed to fit in with Zinacanteco adults' fears about the effects of schooling on their young people and, most important, potentially interfered with the maintenance of cultural continuity.

One very common Zinacanteco fear was that children, especially girls, would stop obeying their parents (Trosper 1967). While we do not have direct evidence on this point, there was an interesting piece of indirect evidence. If we consider obedience to be a particular manifestation of taking a passive role in relation to an authority figure, then another manifestation of this role was the general conversational dominance of teacher over learner during weaving instruction. The one girl in our weaving sample who had been to school was an exception in this regard: she was almost *four* times as active verbally in relation to the teacher as an unschooled girl with equivalent weaving experience. Schooling may make the *itz'inal* (junior) member of a pair more dominant, in this way weakening cultural norms.

Anxiety about cultural continuity was expressed in the universal Zinacanteco fear that a child who had been to school might decide to leave Zinacantán (Trosper 1967), thus breaking his or her ties to the culture. Indeed, literate,

schooled Zinacantecos participating in a study of cultural norms considered "wants to be a non-Indian" to be an attribute of good behavior (Cancian 1971b).

One important threat to cultural continuity is to go beyond the model provided by an authority figure to produce a novel result. Among our experiments, there was one task, continuation of the "growing pattern" in the pattern-representation study, in which this was possible. In the "progression" strategy, the subject transcends the model to produce novel elements. It seems significant that the only Zinacanteco subjects who used this strategy were boys who had attended school. Here is an indication that schooling posed a threat to cultural continuity by influencing students to go beyond the models presented by authority figures.

Another important aspect of cultural continuity was the distinctive education of girls and boys, foretold in the birth ritual described at the beginning of this essay. But a key characteristic of school, one which we generally take for granted, is that, in school, boys and girls are generally (in principle if not always in practice) taught the *same* rather than *different* things. Indeed, we did find evidence that boys, as a result of going to school, acquired some cultural knowledge (analytic representation of Zinacanteco woven patterns) that, without school, was reserved for females. Thus when it came to representing woven patterns, using sticks in a frame, the oldest schoolboys resembled the female weavers, rather than the unschooled boys of similar age, in taking the analytic approach to the task described earlier (and shown at the top, left of Figure 5).

Given the Zinacantecos' concern with differentiating the education of boys and girls, it is noteworthy that, where differences in rate of cognitive development were found in our studies, it was gender rather than schooling that made the difference. In both cases where a gender difference was found, the tasks were culturally irrelevant ones—(1) sorting rods and (2) representing culturally novel patterns. In each case, boys developed more rapidly or farther than girls, while the performance of schooled boys did not differ from that of their unschooled male peers. These results probably reflect the fact that, in traditional Zinacanteco informal education, Zinacanteco males were given broader experience in the world outside Zinacantán and were expected to develop the more general problem-solving skills useful in economic transactions with the *ladino* world.

THEMES FROM BIRTH TO MATURITY IN ZINACANTAN

Several themes anticipated at birth appeared repeatedly in these developmental studies.

Transcultural Nature of Developmental Stages and Adult Behaviors

The sequence of behavioral milestones exhibited by Zinacanteco babies are indicative of a universal, maturationally based plan of infant development. In the nesting cup task, Zinacanteco children showed the same developmental sequence of strategies as United States children. Given their lack of familiarity with toys, this sequence must also have had a maturational foundation. In

teaching their children how to nest the cups, Zinacanteco mothers, like United States mothers, adapted their teaching strategies in relation to the skill level of their children, not to the success of one strategy over another.

Comprehension of kinship terms showed the same developmental process of decentration posited by Piagetian theory, despite our different predictions based on the complexity and cultural importance of the Zinacanteco sibling system. Given that factors in the cultural environment cannot be responsible for the sequence, a maturationally guided plan of development must once again be the key. Similarly, the children in the classification study were in the same stages at the same ages as United States and European children. In the pattern representation tasks, stages of development followed the sequence of increasing differentiation and hierarchical integration predicted by Werner's (1948) universalistic theory. In the weaving study, teachers showed the same sensitivity to the skill level of the learners that appeared in the nesting cup study, adjusting both the difficulty of the task and their teaching techniques. This pattern of results has also been found in the United States (e.g., Kaye 1977; Greenfield 1984).

Physical Activity Level

The low level of physical activity apparent in Zinacanteco infants at birth was further reinforced by the practice of swaddling. Nursing at the slightest sign of movement further reduced motor activity. Children tested in the first year of life, when compared to United States norms, showed a delay in the development of motor skills that was greater than their slight delay in mental skill development. A low level of motor response at birth was consonant with a small amount of fine motor (eye-hand) experimentation during the first year of life. There was additional evidence of low motoric activity in older children who sat observing for long periods when learning to weave and in adults in the nesting cup task, where mothers infrequently used the more physically aggressive teaching strategy of "shoving" the baby's hand.

A low level of physical activity was the norm in Zinacanteco adulthood. Restricted motion was adaptive for the Zinacanteco mother who nearly always had a baby on her back and, during her childbearing years, must 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 1978:243). Quite astonishingly, Leslie Haviland's description of female body movement is remarkably reminiscent of Brazelton, Robey, and Collier'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 1978:243). This is not merely the way Zinacanteco women *actually* move, this is also the way they are *supposed* to move. Creating striking ontogenetic

continuity, an innate newborn behavior ultimately becomes a culturally valued adult behavior.

Response versus Individual Initiative

Zinacanteco newborns, quiet and alert, attentively observed their surroundings, laying the foundation for later observational learning. They did not cry intensely or flail about, demanding that someone react to them. The pattern of response versus initiation that first appeared when the newborn received the tools that symbolized its predetermined role in Zinacanteco society was reflected again and again in the Zinacanteco child's later development.

Infants showed little interest in playing with an object beyond imitation. In frequent nursing, 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 year-old American children did. They developed investment in objects later and seemed to have less interest in manipulating them on their own.

We had expected children who were asked to classify and reclassify flowers and rods to find the culturally familiar flowers easier to work with. This was not the case. We asked them to sort flowers in ways that flowers were not ordinarily sorted, and they, influenced by the Zinacanteco concept of there being only one true, or *batz'i*, way to do things, found the familiar flowers harder to sort than the unfamiliar rods.

This lack of ability to innovate also appeared in the pattern representation study. The "growing" pattern was treated imitatively by all the unschooled children, and the weaving girls had less success than nonweaving boys in continuing all the unusual (i.e., not Zinacanteco) patterns. Boys, and schooled boys in particular, showed the influence of the outside world in their superior ability to transfer skills and to treat the tasks analytically. That schooling could promote individual innovation 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.

Like Zinacanteco newborns, the girls in the weaving study showed a remarkable ability to observe an adult attentively for long periods of time. They did not often initiate conversation. Commands from teacher to learner were of primary importance as a teaching technique, illustrating the Zinacanteco principle of senior/junior, or *bankilallitz'inal*. There was no encouragement of individual initiative through trial-and-error learning.

Behind this predominance of response over initiative on the part of Zinacanteco children lies the traditional culture of Zinacantán with its *batz'i* way of doing things and its emphasis on the *bankilallitz'inal* relationship. Cultures can change, however.

Actual and Potential Effects of Culture Change. Now, in the 1980s, fifteen to twenty years after the developmental studies were done, Zinacantecos own and

operate many of the trucks used for commerce and transportation in the highlands around San Cristóbal de las Casas (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 very gradually come to place relatively greater emphasis on innovation, individual initiative, and manipulation of objects, and relatively less on maintenance of tradition. Going one step further, we predicted that new methods of weaving instruction would follow and would lead, in turn, to new woven patterns and constant pattern innovation. The prediction about novel patterns has been borne out; new woven patterns are now rife in Zinacantán (Frank Cancian, personal communication 1987). It only remains to return to study the instructional process and patterns of senior-junior interaction to see if there has been further disruption in the beautiful continuity of the traditional way.

CONCLUSIONS

Our set of studies may offer what is to date the most comprehensive view of cognitive development, learning, and cultural values in a nontechnological culture. Such a variety of experimental and observational methods across such a broad age range is, to our knowledge, unique in the literature.

From a theoretical point of view, these themes show, on the one hand, that it is possible to find continuity in developmental style from birth to maturity and that the source of this style continuity lies in a specific cultural context—in this case, the culture of Zinacantán. On the other hand, we see that culturally defined style occurs within the framework of transcultural patterns of child development and maternal behavior. The force behind these transcultural patterns of *child* development would seem to be genetically guided patterns of maturation. At the very least, the transcultural similarities in *maternal* behavior must reflect the capacity of our species to adapt to the functional requirements of an instructional situation.

We seem to have found a new answer to the old 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*. Culture-specific forces, in contrast, shape the *stylistic* aspects of these patterns, providing continuity in behavioral style across diverse developmental stages.

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 uniquely fortunate: first, in being able to plan our studies on the foundation of ten previous years of ethnographic fieldwork; second, to have been given cultural training and collegiality by Zinacanteco associates and American researchers experienced in Zinacantán (including members of our own team); and, now, to have twenty-five years of multidisciplinary study of Zinacantán

upon which to base our cultural analysis and interpretations. All of this was made possible by the Harvard Chiapas Project, founded and continuously directed by Professor Evon Z. Vogt, to whom this volume is dedicated.

ACKNOWLEDGMENTS. As a pediatrician, Vogtie opened my eyes to how deep cultural differences can be and to the variability in human behavior. He had the vision to encourage interdisciplinary collaboration and provided a unique opportunity to develop the Brazelton Neonatal Assessment Scale. He has been a dear friend ever since.

T.B. Brazelton

At a time when my cross-cultural research had been cut off by family responsibilities (a baby, a three-year-old, and a husband still in medical training), the context provided by Vogtie and the Harvard Chiapas Project made meaningful short-term cross-cultural research possible, allowing me to continue in the field of cross-cultural developmental psychology.

I am particularly grateful that Vogtie gave me Carla Childs, then a junior at Radcliffe, as an assistant. She was an experienced fieldworker in Zinacantán with excellent Tzotzil skills and a strong interest in child development and education. The research could not have been done without her, and our friendship made the fieldwork a great pleasure.

Now, more than ever, I appreciate Berry Brazelton's invitation to go to Chiapas to follow up his exciting and challenging research with Zinacanteco babies. The task he set—to place Zinacanteco infancy in a broader developmental and cultural framework—has finally been achieved in the present essay.

But Berry's contribution was far more than a scientific one. If I had not had my pediatricians with me in Chiapas (Berry one month, J. Robey the other), I would never have dared to go into the field with a baby who had been seriously ill most of his short life.

I am most appreciative to Victoria Bricker and Gary Gossen, whose (heroic) efforts as editors stimulated this essay and enabled me to work once again with Carla Childs and Berry Brazelton.

I am grateful for the careful tending that Nan and Vogtie gave to the Chiapas Project archives over the years and for Vogtie's generosity in making the archives—a unique and precious resource—available to me for this paper.

My special thanks to Leslie Haviland for sharing her thesis and, especially, her incisive unpublished observations. Thanks also to Francesca Cancian for help in tracking down a paper missing from the Chiapas Project archives, to Laura Weiss for graphic illustrations and help with manuscript preparation, and to Pierre Dasen for comments on an earlier version of the paper.

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P.M. Greenfield

Most of the important learning in my undergraduate experience took place as a result of my association with the Harvard Chiapas Project. As a sophomore, I felt lucky to be chosen, but I really had no idea where that first forty-eight hour bus ride would lead. I found myself not only in the world of Zinacantán, but also in the equally fascinating world of the ideas and personalities of my Harvard associates. Vogtie and Nan made me feel as welcome as if I had always been there. My interest in other cultures was deepened and made more specific. I was thrilled to be able to take on the challenge of learning to use a new and strange language. The other researchers taught me the value of examining an idea from different viewpoints. My enjoyable and enduring partnership with Patricia Greenfield introduced me to the field of developmental psychology and forced me to think more rigorously.

I am thankful to Vogtie for giving me the opportunity to participate in the Harvard Chiapas Project, and to both Vogtie and Nan for making my years with the project such a warm and rewarding experience.

C.P. Childs

We would also like to express our collective thanks to George Collier and John Robey, who worked with Brazelton, to Xun Pavlu, who served as the assistant to Greenfield and Childs, and to Xunka Pavlu for her unfailing hospitality and kindness during Greenfield and Childs' work in Nabenchauk. We are especially grateful to all of the Zinacanteco families who participated in our studies.

Finally, we want to acknowledge Nan Vogt's important contribution. Her warmth and generous hospitality—combined with extraordinary skills in creating festive occasions for people to come together—provided the chemistry that made the Harvard Chiapas Project work.

END NOTES

¹ "The tutelary gods are ancestral gods who watch over the town. The 'meeting place' is Calary, the principal shrine overlooking Zinacantán Center" (Laughlin 1980:161).

² This role was further reinforced in early childhood when "girls have toy looms for make-believe weaving, and little grinding stones and pots for making tortillas and carrying water" (Cancian 1963:63-64).

³ Differing slightly from this observation, note that Anton Teratol had been clothed *before* the ritual proceedings, according to his father's description.

⁴ Actually, male's older brother versus male's younger brother.

APPENDIX A ZINACANTECO NESTING CUP STUDY

Because this study has not previously been published, details of method and results are presented in this appendix.

METHOD

Subjects

The participants in our study were thirty Zinacanteco mother/child pairs from the hamlet of Nabenchauk. The age of the children ranged from nine to seventy months. Age was assessed by asking for age in years and finding out the month of birth. There were sixteen girls and fourteen boys in the sample. Analyses of the manipulative behavior of the babies and the nonverbal teaching strategies of the mothers were based on the full sample. Analyses of the verbal teaching strategies of the mothers were based on a subsample of eighteen mothers for whom complete Tzotzil transcripts were available.

Procedure

Testing took place in an empty Zinacanteco house. The baby or child was seated with the mother on the floor of the house. (This is the normal position for Zinacanteco women.) The experimenter (Childs) was seated on the floor facing mother and child. A recorder (Greenfield) coded nonverbal responses and audio recorded verbal dialogue.

First phase (pretest). In the familiarization portion of the procedure, the experimenter laid out five blue plastic nesting cups of different sizes ranging from 1 7/16 inches in diameter to 2 5/8 inches in two rows in a nonseriated order. She then said to the mother: *Ak' o takinuk schi' uk ixtotal, schiuk basoetik, lavole.* "Let your child play with the toy, with the cups." For the first trial in the pretest, the experimenter then said to the mother: *Ta ora ak' o spas stuk. Muxachanubtas. Mu xavak' be yil,* "Now let him/her do it alone. Don't teach. Don't show him/her." The experimenter then demonstrated the subassembly method of nesting the cups (see Figure 1) and said to the child: *Tahinan schi' uk ixtotal, schi' uk basoetik,* "Play with the toy, with the cups."

The concept was that the nature and extent of the child's imitation would reveal his or her stage of cognitive processing or comprehension of the demonstration.

The second trial of the pretest was the same as the first, except that the experimenter gave the child the largest cup to start with. The point here was to see whether the child was able to put down the cup and start with a smaller acting cup required to seriate the cups or whether the child would make an egocentric identification of cup and hand.

Trial 3 consisted of a repetition of Trial 1. Trial 3 was the baseline from which

the impact of maternal teaching was assessed. Trial 3 was also compared with performance on Trials 1 and 2 to assess the impact of practice without teaching.

If in any part of the pretest or posttest, the child succeeded in serializing all five cups, the experimenter gave him/her a sixth blue cup, intermediate in size between the third and the fourth cup, saying: *Tik'o li hun basoe. K'elo mi x'och*, "Stick in this one cup. See if it goes in."

Second phase (teaching). The experimenter then introduced the teaching phase of the experiment as follows to the mother: *Chakak' be avil. Chahchanubtas. Paso yech*, "I'll show you, I'll teach you. Do it this way."

The experimenter then demonstrated the subassembly method, handed the mother the smallest cup, and let her do it. The experimenter corrected any errors. After the mother got the cups together in the demonstrated manner one time, with or without help, her practice was stopped. The experimenter then said: *Chanubtaso lavole*, "Teach your child." The experimenter took her cue from the mother as to when to end the teaching.

Third phase (posttest). For Trial 1 of the posttest, the cups were put back on the floor and the experimenter said: *Ak'o spas stuk. Mu xavalbe*, "Let him/her do it alone, don't speak to him/her."

In Trial 2 of the posttest, the experimenter demonstrated the subassembly method and laid out the cups, as in the first part of the pretest, instructing the mother as follows: *Mu xachanubtas. Mu xavalbe*, "Don't teach. Don't speak to him/her." Then the experimenter said to the child: *Tahinan schi'uk ixtotal schi'uk basoetik*, "Play with the toy, with the cups."

Table 1

Percentage of Children at Different Ages Showing Investment in First Cup¹

Months		
9-15 (N=5)	21-30 (N=8)	35-70 (N=15)
20%	62.5%	87%

¹ This measure is based on Trials 1 and 2 of the pretest. If on either trial, the first cup touched became the moving or "acting" cup, this was counted as egocentric identification or investment. On Trial 1, the child chose the first cup; on Trial 2, the experimenter handed the child the biggest cup to start with. If the child tried to use this cup as the moving or "acting" cup, such a move would be incompatible with serialization. It was planned to use only this trial as a measure of egocentrism, but very few of the youngest children responded at all to this situation.

Table 2

Percentage of Children at Different Ages Utilizing Different Dominant Strategies in Trials 1 and 2 of the Pretest

MONTHS	TYPES OF STRATEGIES		
	Strategy 1 (Pairing Method)	Strategy 2 (Pot Method)	Strategy 3 (Subassembly Method)
9 - 15 (N=5)	80%	20%	0%
21 - 30 (N=8)	0%	87.5%	12.5%
35 - 70 (N=15)	0%	93%	7%

Table 3

Mothers' Verbal Instructions
Average Percentages of Different Types of Verbalization¹

AGE OF CHILDREN IN MONTHS	MOTHERS' VERBALIZATIONS	
	Commands	Other Types of Verbalization (Statements, Questions, Explanations)
9 - 15	90%	10%
21 - 30	89%	11%
35 - 70	87%	13%

¹ The percentages in the table are based on the verbalizations of 18 mothers: four mothers of 9-15 month olds, five mothers of 21-30 month olds, and nine mothers of 35-70 months olds. Due to equipment problems, we lacked auditory records for the other mothers who participated.

Table 4

Percentage of Mothers Using Different Dominant Teaching Strategies with Children Utilizing Different Dominant Manipulative Strategies

CHILD STRATEGY	MOTHER STRATEGY		
	Shape	Show	Shove
Strategy 1 (Pairing) (N= 4)	75%	25%	0%
Strategy 2¹ (Pot) (N=18)	41.7% ¹	52.8% ¹	5.5%
Strategy 3² (Subassembly) (N=3)	11% ³	44.3% ³	44.3% ³

¹ One mother used "shape" and "show" equally; she contributed one-half to the raw score for each category.

² Includes children producing equal mixtures of Strategies 2 and 3.

³ One mother used "shape", "show", and "shove" equally; she contributed one-third to the raw score for each category.

APPENDIX B

Before asking our subjects any question, we elicited family trees from their mothers which gave the names of all the household members and showed the kinship relationships between them. Here is the sibling portion of a sample family tree.

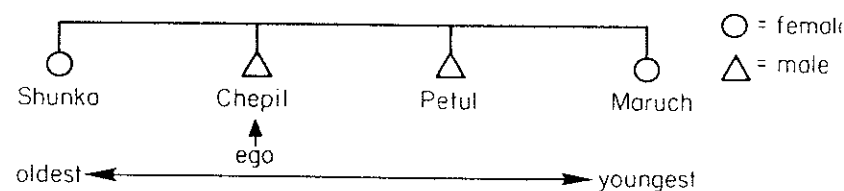


Figure 6. Sibling portion of a sample family tree.

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. Zinacantecos use six sibling terms: 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 to his siblings. For the sample family tree above we would compose three such "ego-centered" questions for the boy Chepil, for example:

Tzotzil: K'usi sbi lavixe?
English (literal): What his-name the-your-older sister?
English (free): What is the name of your older sister?
Answer: Xunka

For the same sample family tree we would address seven such "other-centered" questions to Chepil, using each of his three siblings in turn as the reference point, for example:

Tzotzil: A laviz'in Petul
English (literal): As for the-your-younger brother Petul
k'usi sbi lisvixe?
what his-name the-his-older sister?

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English (free): As for your younger brother Petul, what is the name of his older sister?

Answer: Xunka

For the sample tree, three of the "other-centered" questions would involve a reversal of perspective. The answer would contain the name of the subject himself, for example:

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

A: Chepil (or me)

We asked all of the questions in the singular form, even when a complete correct answer included more than one person. After each response, we asked subjects a follow-up question like the following:

Tzotzil: Mi oy to svix?

English (literal): ? there is still his-older sister?

English (free): Does he have another older sister?

We repeated this question until the subject had told us that there were no more.

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