Abstract In *Weaving Generations Together*, Greenfield describes a long-term project spanning two generations of mothers teaching their daughters how to weave. The author considers the economic and social changes that took place in the Mayan village of Nabenchauk between the 1970s and the 1990s, and explains how they affected weaving apprenticeship and the creative and cognitive processes involved in it. We sympathize with this situated analysis of learning, creativity and cognition, and applaud Greenfield's unique contribution to the understanding of human development under shifting socioeconomic circumstances. At the same time, we highlight the need to enrich the author's account in two distinct ways: (1) by favoring a developmental perspective to the study of changes in practices and psychological phenomena that involves the analysis of processes of transformation and not only the description of differences observed across time; and (2) by specifying the relationship between cultural practices and internal processes. A call is also made to further the discussion about the assumptions that underlie the author's sociocultural approach.

Key Words cognitive development, creativity, learning styles, sociocultural theory, weaving

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Weaving Sociocultural Change and Cognitive Development Together

Greenfield, Patricia Marks, *Weaving Generations Together: Evolving Creativity in the Maya of Chiapas*. Santa Fe, NM: School of American Research Press, 2004. ISBN 1–930618–28–X (pbk)

In her book *Weaving Generations Together,* Patricia Greenfield presents an account of the nature and course of human development that suggests a tight relationship with sociocultural change. During two extensive stays in the Zinacantec Mayan hamlet of Nabenchauk, Mexico, in 1969–70 and 1991, Greenfield studied weaving, the typical activity of Mayan women, and developed a long-term project spanning two generations of Zinacantec mothers teaching their daughters how to weave. The results of this project are documented in the book, initially

Vol. 13(4): 500–512 [DOI: 10.1177/1354067X07082808]

developed as a catalog for a museum exhibition; as well as in multiple scientific reports by the author and her collaborators (e.g., Childs & Greenfield, 1980; Greenfield, 2000; Greenfield, Maynard, & Childs, 2000; Maynard & Greenfield, 2003; Maynard, Greenfield, & Childs, 1999).

Relying on empirical data accompanied by beautiful photographic work by Lauren Greenfield, the book selects the following foci for study: the ontogenesis of weaving as a product of biology and culture; the transformations in weaving apprenticeship and in the cognitive and creative processes involved in it between 1969–70 and 1991; and the role of sociocultural change in these transformations.

Foundations of Cultural Continuity

In her account of the ontogenesis of weaving, Greenfield integrates evidence from multiple disciplines to depict weaving apprenticeship as the result of the interaction between biological underpinnings and cultural environment. The author's thesis is that to be born and to grow up in the Zinacantec Mayan hamlet of Nabenchauk gives advantages to individuals in the acquisition of the motor and visual behaviors for weaving with the backstrap loom. Among these behaviors, Greenfield describes the case for *restrained movement*, a motor characteristic observed in Zinancatecs to appear from an early age which, the author argues, facilitates the upper-body stillness position that later on allows weavers to hold one of the ends of the loom for long periods of time.

Relying on evidence from comparative studies (i.e., Brazelton, Robey, & Collier, 1969), Greenfield explains that the first indications of restrained movement are observed in Zinacantec neonates. Different from the expansive movements observed in Euro-American neonates, Zinacantec babies rest their arms close to the upper body. This lower rate of motor activity is not unique to Zinacantecs, but has also been observed in other ethnic groups that, like Maya Indians, have Asian roots (Greenfield, 2000). The commonality among these different ethnic groups with respect to motor activity, and the lack of a shared practice during prenatal development among them, lead Greenfield to intuit that genetics plays a role in the appearance of this particular motor characteristic. However, convinced by the idea that human development results from the combined influence of biology and culture, the author looks at how Zinacantec practices around infant care could also play a role. Ethnographic observations show that Zinacantec caregivers swaddle their babies in bands and nurse them at their slightest signals of hunger as a way to limit any expansive body movement. According to Greenfield, this particular practice *reinforces* the innate tendency of

Zinacantec babies for low levels of motor activity, and therefore promotes the restrained movement that weavers require to hold the loom (see Maynard et al., 1999).

This early preparation for weaving, Greenfield explains, continues in early childhood with play weaving, an almost universal activity among girls in Nabenchauk. In play weaving young girls use a toy loom adapted to their body size and their cognitive and manual skills before using the real loom. The function of play weaving, the author explains, is to provide novices with the first opportunity to directly practice the different body positions involved in weaving with the backstrap loom. In play weaving, girls between the ages of 3 and 7 use a toy loom, and it is not until 8 years of age that they start to learn how to weave with a real loom. For Greenfield (see also Maynard & Greenfield, 2003), the transition at this specific age is not coincidental, but it is explained by the implicit Zinacantec theory of cognitive development, which she considers corresponds to Piaget's theory. When using the real loom, older girls and women required a separate apparatus, a warping frame or *komen*, where the warp is prewound. Greenfield's proposition is that using this apparatus involves mental transformations such as the ones described in Piaget's stage of concrete operations, since the weaver needs to mentally transform the configuration of threads on the warping frame into the configuration of threads on the loom. Conversely, setting up the toy loom does not involve the use of the *komen*, since its composition allows the weaver to wind the warp directly on the loom. Therefore, the use of the toy loom does not involve mental transformations and sensitively adapts to the cognitive abilities of young girls.

Apprenticeship Transformed

Greenfield moves on to a description of the historical, economic and social changes that the Zinacantec community underwent between her two main visits. The author contends that not just the culture itself, but also the processes of cultural learning and cultural transmission transformed over time. Greenfield's argument in this section is that the macrolevel of social change is closely related to the microlevel of individual development. She explains that between her two main observations the Zinacantec community experienced a qualitative change in its economic structure and way of living.

In the 1970s, agriculture was the main economic activity in Nabenchauk, and the Zinacantec social world was governed by three main themes, which were omnipresent in all aspects of their life, ranging

from social relations to weaving. The first theme was respect for tradition, which was reflected in the strict adherence to the pre-established use of objects and the wearing of traditional Zinacantec clothing. The second theme was the strong interdependence between members of the community. All families in the Zinacantec Mayan hamlet lived in one-room houses, and no one ever slept alone. The third theme was the age-graded flow of authority. The older members of the community were highly respected, since they owned most of the land. At the family level, authority flowed from mothers to older siblings to younger ones.

Between the 1970s and 1990s, the economic structure of the Zinacantec community changed from an economy based on agriculture to a developing commercial one. Money-based, commercial activities became increasingly prominent. Men abandoned their former roles as farmers and bought cars and vans, making possible the transportation of business, and women entered textile commerce by weaving items for sale to outsiders. This advent of entrepreneurship did not only change the economic structure, but also social life. The book's central hypothesis is, in fact, that the introduction of entrepreneurship carried the value of innovation, which stands in clear contrast with the traditional Zinacantec values. Innovation and individual initiative contrasted with tradition, undermined the value of interdependence and disrupted the age-graded flow of authority in the Zinacantec community.

These transformations were visible not only at the macrolevel of cultural change, but also at the microlevel of cultural learning and transmission of cultural values, such as Greenfield clearly explains for the case of the weaving apprenticeship models from both historical junctures. The cultural model of weaving apprenticeship of the 1970s, she explains, was characterized by adherence to tradition, emphasis on physical and cognitive interdependence and the natural flow of authority from the teacher—the mother—to the apprentice—the daughter. Learning to weave consisted of learning how to re-create the four *true* Zinacantec patterns. Weaving was guided by the teacher, who ensured that the apprentice attained the same exact skills and sets of patterns as her predecessors. The mother worked physically close to the novice, leaving very little room for error. She limited the novice's opportunities for experimentation, innovation and trial-and-error learning. The teacher–apprentice relationship also clearly illustrated the age-graded flow of authority. In cases where other siblings were involved in the learning process, authority flowed from the mother to the older daughter to the younger one.

In contrast, the cultural model of weaving apprenticeship in the 1990s incorporated an increase in trial-and-error learning. Novices had greater opportunities to experiment and to be playful. Respect for tradition was weakened by the introduction of innovation in the realm of weaving patterns and embroidery. The teacher's age and guidance decreased, as did the interdependent aspects of the learning process. The physical distance between the teacher and the apprentice increased, and the latter had to demand help from the former rather than constantly having the teacher's undivided attention. The age-graded flow of authority was gradually eroded. As the mothers became more commercially involved, the role of the teacher was transferred to older sisters or cousins. Moreover, the introduction of formal schooling endowed daughters with certain skills (e.g., the ability to read patterns imprinted in paper) that their mothers did not have, thus further contributing to the disruption of the age-graded flow of authority. Therefore, this model clearly depicts how macro changes at the economic level brought about changes at the level of family and individual.

Revolution in Textile Designs and Creativity

From a discussion of the transformation of weaving apprenticeship, Greenfield turns to a description of the revolution in textile designs. She describes how economic changes in Nabenchauk influenced the patterns of decoration of garments and the creative processes around them. Following her economic hypothesis—that macro changes bring about changes at the microlevel—Greenfield describes the innovative, variable and individuated decoration patterns of clothes produced during the commercial period, and explains how they differ from the textile productions of the agricultural period, which contrastively display conservative and uniform patterns of decoration.

The author attributes the accelerated rate of change in the production of textiles to the introduction of innovative elements in the designs and the individuation that came with this introduction. For example, detailed analyses of photographs from the period between the 1940s and 1970s show that the basic rules of the men's poncho were preserved throughout the early agricultural years: its rectangular symmetrical shape, its embroidered holes on the borders, tassels, and a characteristic red-and-white striped pattern. By the 1990s, novel designs were introduced with embroidered flowers coming out of its borders and sides. By 2000, that embroidery was extended to the whole poncho, becoming an all-over rather than a side–border design, hence

breaking two basic rules of the ancient poncho: its symmetry and its red-and-white striped pattern. Moreover, Greenfield also explains that uniformity ruled in the clothing pieces in the 1970s, when the clothing pieces were similar from family to family. Men's ponchos were standard from picture to picture. By the 1990s, this standardization disappeared, and variability in the motifs and details of the arrangement of the designs made room for individuation for all kinds of pieces.

Transformation did not occur only in the domain of textile designs, but also at the level of the creative processes involved in it. The author identifies three themes that characterized the transformation of creative processes. First, the design creation process became increasingly individuated while still retaining its social nature. Analyses of actual garments reveal that the four textile pattern designs that were shared in the 1970s were replaced in the 1990s by patterns characteristic of distinct families. This change, Greenfield explains, suggests that creativity in textile design in Nabenchauk shifted from the community to the family level. Creativity at the level of the family, much like creativity at the level of the community, was characterized by an emphasis on social processes of design creation, rather than on individual uniqueness. Family members were happy and even proud to copy each other's patterns. Mothers and daughters helped each other during the creation of new designs and gained inspiration from one another. Greenfield contends that the practice of copying from other family members indicates that Zinacantec weavers valued mutual help and the expression of family identity more than the encouragement of a unique, individual creativity. As such, the author contends that family creativity is an intermediate step between community and individual creativity.

Second, Greenfield describes the transformation of the creative processes due to the use of multiple, various source designs. The family textile patterns that replaced the traditional Zinacantec designs did not originate in the mind of a single weaver. Instead, Greenfield argues, they emerged from the blending and transformation of motifs from various sources, both within and outside the Zinacantec community. This integration and transformation of source designs occurred, however, within a set of norms and rules. Thus, even though new designs may appear innovative at the surface level, an examination of their 'deep structure' indicates that they still are truly Zinacantec and clearly recognizable as such by all community members.

Third, Greenfield characterizes the transformation of creative processes as a result of the introduction of new technologies in textile design. The author argues that the flourishing of innovative designs in

Nabenchauk relates to the advent of new representational tools, none of which were used in the 1970s. Among them were printed cross-stitch patterns, systems for tracing patterns from paper to cloth and pulling threads in order to create grids to guide the embroidery of designs. These representational tools were developed in the traditional Zinacantec context of the backstrap loom and clothing items. However, Greenfield asserts, they often originated from individual weavers, who were influenced by technological advancements such as commerce and formal schooling. Once again, historical and cultural changes yielded to changes at the level of creativity and learning.

Changes Inside the Mind

Towards the end of the book, Greenfield describes how the economic shift in Nabenchauk also influenced how the Zinacantec mind operates. She discusses the different ways in which Zinacantecs from both time periods perceived and represented traditional and culturally novel weaving patterns. Greenfield develops this discussion in the context of a description of experimental tasks that were given to children and young adults in 1969–70 as well as in 1991.

In one of the tasks, participants used a pile of colored wood sticks of different widths to reproduce the traditional red-and-white striped designs of the men's poncho and the women's shawl. Comparisons of the participants' productions from both periods show changes in these representations. In 1969–70, participants produced what Greenfield dubs as *thread-by-thread representations*. In these representations, broad stripes of the woven patterns were constructed out of multiple narrow wood sticks placed one next to each other. In contrast, by 1991, participants' constructions of the same woven patterns introduced broad sticks to represent the broad stripes of the poncho and the shawl. This evidence led the author to conclude that Zinacantecs' representations changed from concrete to abstract. Thread-by-thread representations, Greenfield argues, simulate weaving in that the broad stripes of the garments are composed of several threads woven side by side. Participants' constructions in 1991, on the other hand, do not display this correspondence between representation and weaving, and therefore are considered to be more abstract.

Why did this change take place? Greenfield explains the movement towards abstraction by the transition to an economy based on commerce, which involves the manipulation of money. This manipulation, she contends, triggers abstract thinking, since it 'reduce[s] all the details of goods and services to the single abstract dimension of

number' (p. 146). Thus, increased experience with the abstract mode of thinking involved in monetary exchanges could have led to a prevalence of abstract representation of the woven patterns.

In this final section of the book, experimental evidence is also provided showing historical changes at the level of representations of culturally novel patterns. Greenfield describes results from a second experimental task where participants also used wood sticks to continue the construction of a novel design initiated by the researcher. A comparison of the representations from both time periods shows participants in 1991 correctly completed more novel patterns than their counterparts in 1969–70. Whereas participants in 1969–70 imitated the constructions initiated by the experimenter when asked to continue the novel patterns, participants in 1991 provided solutions that went beyond what was presented by the experimenter, thus creating innovative designs. This result, the author argues, supports once again her economic hypothesis: the introduction of entrepreneurship carried the value of innovation, and led to an increase in the ability to understand and represent innovative patterns among Zinacantecs.

A Critique of Greenfield's Approach to Studying the Role of Socio-historical Change in Cognition

Greenfield's approach to the study of the role of sociocultural change in human development relies on the basic principle of activity theory that psychological phenomena cannot be understood if they are analyzed separately, in isolation, from practical social activity, or *praxis* (Leontiev, 1981; Luria, 1971). Along with other contemporary authors (Cole & Engeström, 1993; Hutchins, 1995; Lave & Wenger, 1991; Rogoff, 1990; Saxe, 1996), Greenfield distances herself from mentalistic conceptualizations of culture. Instead of envisioning culture as learned meanings, concepts and symbols shared by a group of people, the book's position is that culture consists of the social activities of individuals. Based on this view, Greenfield favors a culturally situated analysis of cognition that emphasizes its dependency on the economic and social predicaments around people's practices. In addition, she is able to bring the historical dimension into the study by implementing a longitudinal design. This unique application (though for a similar application, see Saxe & Esmonde, 2005) is important because it allows us to understand not only how cultural practices change across time, but also how this change brought about transformation at different levels of ontogenetic development.

Greenfield's long-term project explored the effect of socioeconomic changes in three different aspects of weaving: weaving apprenticeship, creativity and cognition. For the most part, the book provides convincing and interesting arguments. However, some aspects need to be reconsidered.

The author developed a strong case of how an economy based on agriculture led to a conservative model of weaving apprenticeship, and how an economy based on commerce led to a more innovative model of weaving apprenticeship. In drawing these connections, Greenfield presents us with two endpoints of what seems to be a continuous process of transformation from an interdependent, conservative model to a model of apprenticeship that favors independence and innovation. This focus on the endpoints, and not the process of transformation, leaves many questions open, such as: How did the new model of weaving apprenticeship arise? Which of the characteristics of the old model underwent the first transformations? Are there any intermediate stages in the process of transformation? The reader is left alone wondering about these issues.

The approach to the study of how socioeconomic conditions brought about changes in textile designs and creative processes takes a different path in the book. Rather than describing two endpoints, Greenfield discusses the process of transformation for the case of textiles and designs. The availability of pictures from different times and the author's access to garments from the years in which she did not visit the field are probably the reasons that explain this difference in the approach. Greenfield takes advantage of these resources and constructs an account where the focus is on *how* the transformation in garments and creativity took place. We argue, however, that the author could have applied this *developmental* approach to the study of weaving apprenticeship, too. Like her team partner Tsuh-Yin Chen (p. 84), who studied how mothers from another Mayan community who wove for profit and mothers who wove for the family differed in the way they teach their daughters how to weave, Greenfield could have explored how weaving apprenticeship differed among families who have been differently exposed to the recent economic development in Nabenchauk. The book describes that, whereas some families in Nabenchauk still follow a subsistence agricultural way of life, others are deeply involved in commerce. A systematic examination of the implications of these differences for weaving apprenticeship provides a unique opportunity to further the understanding of how transformation of the model of weaving apprenticeship could have taken place in the community during the transition from agriculture to commerce.

The existence of these different levels of exposition to economic development among Zinacantec families also opens the possibility to explore tensions about old and new ways of teaching weaving. Greenfield anticipates the presence of these tensions among community members. However, she only illustrates them by describing an anecdotal episode of a conflict around play weaving that clearly reflects how two families with distinct backgrounds—commerce and agriculture—differently conceived the role of play weaving (see pp. 82–83). The conflict and negotiation that probably accompanied the process of transition of weaving apprenticeship are not addressed in the book, even when their exploration could have also provide a good opportunity to better understand how this process takes place.

Exploring conflict and negotiation also opens the possibility of considering issues related to the role of individual agency in the transformation of cultural practices. Throughout the book, Greenfield focuses on the analysis of events and changes that took place at the level of community, ignoring how changes were constructed by individuals. Naturally, this was not the goal of the book, nor are we asking the author to satisfy this aim.[1] However, it is clear that the study of transformation of culture—whether it is through the study of practices or meanings and symbols—raises questions concerning how individuals negotiate their idiosyncratic systems of practices and meanings in the light of the collective culture.

Consequently, a sociocultural approach to human development requires not only a focus on the collective culture, but also on the individual and the way he or she negotiates, interprets, selects or modifies the input from the collective culture (Lightfoot & Valsiner, 1992; Valsiner, Branco, & Dantas, 1997). Following this principle, it would be interesting to explore how individuals in Nabenchauk construct their personal views of weaving apprenticeship out of the diverse collective input. How does the Zinacantec teacher construct her view of weaving apprenticeship out of the conservative/interdependent and innovative/independent models of weaving apprenticeship that co-existed during her own history as a member of the community?

From the main three aspects explored by the author—weaving apprenticeship, changes in textile designs and creativity, and cognitive aspects—the latter is, perhaps, the most challenging. Greenfield provides a clear description of her experimental evidence, which suggests differences in Zinacantecs' ways of representing weaving patterns in the two different historical junctures: whereas participants in the 1970s created concrete patterns, participants in the 1990s created abstract representations. The explanation of this change, however,

suffers from the weakness that some authors have pointed out in activity theory research. As Ratner (1999) explains, one of the weaknesses in activity theory research is the lack of specificity on how activity shapes psychological phenomena. He argues that it is important to recognize not only that activity influences psychological phenomena, but also that the processes through which this influence takes place. In the book, Greenfield interestingly points to the role of an economy based in commerce and the manipulation of money as the potential factors that brought abstractness to Nabenchauk. However, she fails to specify the connection between the advent of entrepreneurship and abstractness in representational abilities. The reader then wonders: How do commerce and the manipulation of money specifically connect to abstractness in representing weaving patterns? If money manipulation was the trigger for abstract thinking, how did this transferability take place?

Greenfield's project was an ambitious one, and for the most part, the author is able to provide us with convincing evidence, interesting arguments and an account where all of its parts seem to fit perfectly. However, this long-term project is still far from offering us definite answers about major issues and, more specifically, final solutions concerning the role of praxis for cognitive development. A discussion around this topic brings with it more general questions that need to be addressed in any sociocultural approach to human development. Among them, we can mention the major thorny question of the separability—or inseparability—between the individual and the context. How has it been conceptualized in this long-term project? Does Greenfield agree with the inseparability between individual and context that is postulated in activity theory? Chapter 5 (entitled 'Inside the Mind') suggests that she believes in an individual mind, separate from the context. If this is the case, how does she conceptualize this separability? How are the processes of internalization and externalization defined in it? It would be interesting to see how Greenfield positions her long-term project within these provocative discussions, which are prominent in this and other journals (e.g., Kreppner, 1997; Pérez-Campos, 2003; Sawyer, 2002).

Note

1. The lack of attention to this issue, one could think, is explained by Greenfield's alignment with activity theory. Some of the authors following activity theory principles (e.g., Lave & Wenger, 1991; Rogoff, 1990) do not separate the individual from the context, and consider their unit of analysis to be the situated social practice (for a review, see Sawyer, 2002). However,

as we mention above, Greenfield's position on this matter is not clear in the book.

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