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COMMENTARY AND DISCUSSION

COMMENTARY BY PATRICIA M. GREENFIELD[1]

Stevenson, Parker, Wilkinson, Bonnevaux, and Gonzalez entitle their monograph "Schooling, Environment, and Cognitive Development." Besides schooling, they propose to study the effects of location (rural vs. urban) and culture (Quechua vs. Mestizo). This set of independent variables implies an array of tasks that could potentially reflect the effects of the various environmental factors to be studied: schooling, urbanization, Quechua culture, etc. With such a task array, one would, for example, expect Quechuas to do better on tasks calling for skills important in their culture, rural children to do better on tasks reflective of a rural setting, and so on. But no such considerations guided the design and sampling of tasks reported in this *Monograph*. Materials were designed to be comprehensible to children from all groups and settings rather than to be related to the cognitive requirements of any particular setting. The researchers set out to sample a wide range of cognitive skills without considering their ecological validity, the function of the skills in the lives of the various groups being tested. Because so much of the authors' own educational experience has taken place in school, the task sample was bound, by default, to reflect school-related cognitive skills more consistently than the skills fostered by any other aspect of the environment.

Despite the fact that the test battery was biased in the direction of school-related tasks, the results showed some significant cognitive differences as a function of location and culture. The researchers do a good job of interpreting the location effects (some of which favor urban children while others favor rural children) in terms of characteristics of the two settings. But there is a problem in interpreting the effects of culture. This problem stems from an aspect of the design that is never made explicit: the fact that Quechuas were tested in their second language, Mestizos in their first (Spanish in both cases). While it can be argued that it is methodologically better to test everyone in the same language so as to maintain stimulus equivalence, this argument is based on a crude physicalistic notion of stimulus. Clearly Spanish is not an equivalent stimulus for native speakers and for second-language learners. Better to have used one of the accepted methods for obtaining translation equivalence (Brislin, Lonner, & Thorndike 1973) than to have made no attempt to achieve *functional* equivalence of stimuli—the equating of stimuli according to their relation to the participants rather than according to physical characteristics. Good Quechua translations and testers should not have been difficult to obtain in Peru where Quechua is taught as a second language in all schools.

Another valid approach would have been to make a separate assessment of the language effect by comparing performance of matched groups of bilingual Quechua children, testing half of the groups in Quechua, the other half in Spanish. I developed this technique in Senegal where both Wolof and French children are schooled in French; it yielded interesting results concerning the separate effects of language and culture on concept formation (Greenfield, Reich, & Olver 1966).

The social and political dimensions of the language decision become apparent if one considers how much less acceptable it would have been to test both Mestizos and Quechuas in the Quechua language. Yet why not? After all, Quechua is the second language of many Mestizos. Testing Quechua children in Spanish has the unfortunate effect of communicating lack of respect for Quechua culture to the reader.

Even though some Quechua children were eliminated for lack of adequate knowledge of Spanish and the tester was able to translate some troublesome words into Quechua, the Quechua children were still at a disadvantage. Differential facility with the testing language confounds and therefore invalidates any comparison of cognitive performance between the two cultures. Perhaps this is why the authors do not even report (except in an Appendix) the numerous significant differences between Quechua and Mestizo children. They do, however, make a general statement indicating that the Quechuas did better on some tasks, the Mestizos on others. One suspects that the Quechua did more poorly on tasks where language skills were most critical. This hypothesis is supported by the fact that on the most complex verbal task, verbal memory, the two Quechua groups scored the lowest. While the authors hypothesize that the three verbal tasks in the battery reflect quality of verbal stimulation in the home, the Quechua children from Lima score lower than expected on the basis of the author's definition of verbal stimulation but exactly on target if knowledge of Spanish (rather than general verbal stimulation) were the crucial factor.

Cognitive tasks could have been designed to reflect skills important in Quechua socialization. A number of studies of development in various cultures have identified cognitive skills developed through systematic out-of-

[1] This commentary benefited from discussions with Jean Lave, University of California at Irvine.

school learning experiences: in Mexico conservation of quantity was fostered by pottery-making experience among Ladinos (Price-Williams, Gordon, & Ramirez 1969); pattern representation was developed through weaving among the Zinacanteco Indians (Greenfield & Childs 1972; Childs & Greenfield, in press). In Liberia mathematical skills were developed by tailoring (Lave 1977) and quantity estimation through rice farming (Gay & Cole 1967). But even if the authors had taken this approach to sampling cognitive skills with determinate ecological relevance, the problem of testing Quechuas in their second language would still have produced a systematic underestimation of their cognitive level. Whether or not the authors agree that it would have been better to test Quechua children in the Quechua language, it would have been preferable to discuss openly the problem of testing language rather than to avoid the issue by omitting results involving comparison between Mestizo and Quechua culture.

The question then arises as to how much the schooling and location effects reflect a confounding of these factors with opportunities for learning Spanish, for Quechuas would learn Spanish in school as well as in the city. With respect to urbanization, there is evidence that knowledge of Spanish is playing an important role in the results for the Quechuas. Why else would urban Quechua children perform better than rural ones on 11 out of 14 tasks while rural Mestizos outperform urban Mestizos on the same proportion of tasks? On a statistical level, this situation manifests itself in a large number of significant interactions between location and cultural group. It seems that urbanization has negative effects on the Mestizo performance of the experimental tasks but positive effects on Quechua performance because of the opportunities for learning Spanish associated with urban residence. It is interesting that none of the three tasks where rural children from *both* cultural groups outperform their urban counterparts require any verbal responses at all.

The interaction effects that would reflect the confounding of language with schooling are, in contrast, small and sparse, indicating that school does make a large independent contribution to performance on the experimental tasks, apart from its role in teaching Spanish. We must also consider another set of factors that may have been confounded with schooling: sampling factors. In the urban setting of Lima, where 85% of all children attend first grade, who are the 15% from which the nonschool samples had to be drawn? Why does this minority not go to school? Are they less capable? Are the educational interests or backgrounds of their families different? Are they deviant in other ways? Super (1977) found, for example, that a nonschool Kipsigis group in Kenya scored lower than a school group on a memory task even *before* starting school. This may also have been true of the Mestizo children living in the city of Lima. In the rural area of Lamas, in contrast, geographical factors appear to have been a relatively important determinant of school

attendance, and more children were available who did not go to school at all. Although the matter is quite complex (e.g., schooled rural Mestizos were drawn from Lamas while schooled rural Quechuas are drawn from outlying areas), the net effect seems to be that the possibility of more capable children from more educationally oriented backgrounds being selected for schooling—that is, the possibility of sampling bias—would have been greater in the city of Lima than the rural area of Lamas. Such a bias, if it existed, ought, therefore, to have manifested itself in the form of interaction effects between location and schooling, resulting from larger school-nonschool differences in city than country. The results show a number of schooling-location interaction effects, but we are not told the nature of the differences on which the statistically significant interactions are based. In any case, there is another possible explanation for the same interaction effects: schools are better in the city. Within the context of the study's design, it is impossible to separate out this factor from differential sampling bias in the two settings. Either could cause larger school-nonschool differences in city than country. However, the interaction effects between location and schooling are almost always weaker than the main effects of schooling, indicating that school plays a role over and above any sampling problems. Still, the authors ought to have detailed the nature of key statistical interactions and used them to help evaluate potential interference from confounding sampling factors.

Some assessment of preexisting differences between school and nonschool groups was also possible through analysis of parent interviews. Yet interview data are not broken down according to whether the child of a respondent attended school or not. In fact, we are not even told whether the interview sample included parents of both school and nonschool children. All in all, sampling factors have been ignored by the authors in the interpretation and discussion of results, although their study yielded a fair amount of data that would have been relevant to this important issue.

Because of possible sampling problems, it is all the more crucial that Stevenson et al. have tested the effects of schooling in a multifaceted way. Sampling problems do not, for example, appear to interfere with the comparison between 5- and 6-year-olds from upper-middle-class homes in Lima. While this comparison shows fewer significant differences than the comparison between schooled and unschooled 6-year-olds from poor families in Lima and Lamas, where sampling could have been a problem, 6-year-old middle-class schoolchildren still outperform their preschool counterparts on a number of cognitive tasks.

An interesting aspect of the results is the large effect of just 1 year of schooling on the development of cognitive skills. Super (1977) has also demonstrated effects of 1 year of schooling. His results differ from those of the present study, however, in that school effects are limited to two areas: general testability—the tendency to complete a test—and visual analysis and reproduc-

tion. Super concludes that there is no evidence from his data that 1 year of schooling improves other skills, such as speed of information processing or logic. Super's results make one wonder about the extent to which the seemingly more generalized effects of 1 year of schooling in Peru may actually be an artifact of increased testability.

Indeed, Stevenson et al. found schooling to have a significant effect on *all* cognitive tasks in the battery. Compare the results of Sharp, Cole, and Lave (undated), who used a large test battery to compare the impact of age and schooling in the Yucatan peninsula of Mexico. While they found performance on most of their tasks affected by years of schooling (independent of age), this was not true for every task. The tasks unaffected by schooling differ from items included in Stevenson et al.'s battery, so the results of the two studies are not actually in conflict. The findings of Sharp et al. do, however, illustrate the dangers of overgeneralizing the effects of schooling to all cognitive skills.

Studies which attempt to separate the effects of age and schooling bring to light an interesting conceptual problem. The description of the authors' various designs for data analysis states that age-related differences can be assessed by comparing 5- and 6-year-olds. It later turns out that much greater changes between ages 5 and 6 occur when 6-year-olds are in school than when they are not and that those cognitive changes are therefore primarily a result of schooling, not maturation. If, however, cognitive tasks had been designed to tap skills being acquired at home between age 5 and age 6, the performance of unschooled children ought to have improved between age 5 and age 6 in similar fashion. The point is a *reductio ad absurdum:* one can only assess the pure effects of maturation, untainted by experience, if one uses tests that are totally removed from the experience of the children being tested.

One of the most interesting findings was that schooling seems to have the same relative impact on cognitive performance in different cultures, locations, and social classes. Comparison of schooled and unschooled children of the same age or before and after starting school showed large cognitive differences across settings, although absolute levels of performance were quite different. Thus, Stevenson et al. demonstrate that schooling has a profound effect on the development of certain cognitive skills even though it does not necessarily equalize those skills. This point seems to have been missed by popular interpretations of Jencks, Smith, Acland, Bane, Cohen, Gintis, Heyns, and Michelson (1972) which say that schooling has no effect if it does not lessen both group and individual differences. Stevenson et al. demonstrate clearly that schooling can raise performance on certain cognitive tasks across different cultures, locations, classes, and starting levels. If readers come away with the realization that schooling may have a tremendous impact on cognitive performance independent of its capacity to erase group differences, this *Monograph* will have served a valuable function.

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REPLY BY THE AUTHORS

We are pleased to amplify our discussion in response to several of the points raised by Patricia Greenfield.

Language of Testing

A topic of prime concern in cross-cultural research is the language in which the subjects are tested. Obviously, children must comprehend what they are asked if any study is to have validity. In discussing languages in

which children may be tested in Peru, it is important to realize that Quechua is the dominant language of the highlands among the Indians but not of the coastal or jungle regions. Testing highland children in Spanish could communicate a lack of respect for Quechua culture, but it is less likely to be the case elsewhere. Since individuals in the city are often seeking transition to Mestizo status and since improving one's economic position is dependent upon developing fluency in Spanish, Quechua residents of the city regard Spanish as the more useful and prestigious language. In the jungle, too, the Quechua acknowledge the importance of Spanish for economic advancement and are eager to have their children learn Spanish.

Quechua is only rarely used as the language of instruction in Peruvian schools. Its use is limited to a small number of schools in the highland regions of Cusco, Apurimac, and Ayacucho. Nor is Quechua taught as a second language in many Peruvian schools. Although a law was enacted during the recent administration of Velasco-Alvarado to make instruction in Quechua a part of every school's curriculum, the law has never been put into effect. There proved to be too few Quechua-speaking teachers and too few books and teaching materials in Quechua to make the two-language system feasible. Thus, although officially Quechua is one of the two languages of instruction, it has not attained this status in practice.

There is generally no problem in obtaining bilingual examiners in Peru. We had difficulty, however, in locating villagers in the Lamas area who could function as examiners and who were completely bilingual. Rather than bring in outside examiners, we chose to hire local residents who knew some Quechua and were familiar with the Mestizo and Quechua cultures of the region.

Recently, we have undertaken a new research project in Peru. In order to determine the language for testing each child we devised two diagnostic language tests in cooperation with an expert in bilingualism. The children were asked questions in Quechua and Spanish that required either verbal or motor responses. The tests were quickly abandoned. Examiners in both Lima and Lamas found them to be time-consuming, frustrating to the children, and of little value. Except for some villages in the Lamas area, the children's fluency in Spanish exceeds their ability to speak and understand Quechua. The examiners found informal conversation to be a much more satisfactory approach to assessing a child's language abilities.

Even though examiners in our current study are fluent in both Quechua and Spanish, Quechua versions of our materials have been used with none of the Lima children and with only approximately 20% of the Quechua children in the Lamas area. (In contrast, approximately 90% of the highlands children included in the study have been tested in Quechua.) It is important to note that this was the case even when the children lived in remote villages. In our first study the majority of the Quechua children were from Huaico, where the children had daily interaction with Mestizos and were fluent in Spanish. Moreover, if the children in the first study could not respond to the Spanish questions of the examiner, they were not tested.

We conclude that Quechua children of Lima and most Quechua children in the Lamas area are at least as skilled in Spanish as in Quechua. We cannot believe, therefore, that our failure to test children in Quechua had the pervasive negative effects on the children's performance that is implied in Greenfield's comments. Indeed, it appears as if the performance of many of the Lima and Lamas children may have been less satisfactory if they *had* been tested in Quechua.

Comparisons of Quechua and Mestizo Performance

A second point raised by Greenfield concerns differences between the performance of Quechua and Mestizo children on various types of tasks, and she stresses language of testing as a basis for interpreting differences in the performance of the two cultural groups.

We selected samples of children for our study so that their economic level would be as similar as possible. Even so, there were clear differences in the status of the Mestizo and Quechua children living in the urban and rural areas. In the city the environmental conditions of the Mestizos and Quechua are relatively similar. However, nearly twice as many Quechua as Mestizos, 40% versus 22%, state that moving to the city improved their lives (Valdivia Ponce 1970). The Quechua of the jungle have a much more disadvantaged status than the Mestizos of the Lamas region. It is not surprising, therefore, that numerous significant differences in performance emerged between the two cultural groups in Lamas, but not in Lima.

Data for specific tasks do not indicate that the Mestizos did better on the verbal tasks and Quechua children on the nonverbal. For each child, 21 scores were available from the memory tasks and the two versions of the cognitive tasks. Among the 5-year-olds of Lamas who did not attend Nidos, the average value of every score of the Mestizo children was higher than that of the Quechua children. In Lima, however, there were few differences between the scores of the two groups. If we look only at scores where there was an average difference at least one point in raw score (a value beyond which significant differences could emerge), we find that for the 5-year-old Lima children three scores were higher for the Quechua children (concrete and abstract forms of concept learning, and abstract form of coding), and three were higher for the Mestizo children (serial memory for numbers, concrete version of categories, and Draw-a-Person). There is no indication that the latter tasks were especially dependent upon language.

If we look next at the performance of nonschooled 6-year-olds, only on Draw-a-Person did the Mestizo children of Lima achieve an average

score more than one point higher than the Quechua children. In Lamas, 11 scores of the Mestizo children were higher than those of the Quechua children by one point or more. Verbal memory was one of these tasks, but others included enactive memory, serial memory for pictures and patterns, and abstract forms of concept learning, coding, and seriation. We assume that the children understood the instructions for these tasks, for on the concrete versions of some of the same tasks (concept learning and seriation) and on serial memory for words and numbers, pictorial memory, incidental learning, perceptual learning, and Draw-a-Person the difference between the average raw scores for the two groups of children was small, ranging between −.75 and .66. It should be stressed that these are data for children who did not attend school and thus had not been taught Spanish by their teachers.

There is little support, therefore, for the proposal that differences between the performance of the two cultural groups can be traced to language of testing. When differences did emerge, they were as likely to be found on performance tasks as on those that involved verbalization or verbal instruction of any detail. Level of environmental stimulation rather than deficiencies in understanding Spanish still appears to offer a more parsimonious explanation of the data related to cultural group.

Location and Schooling

Greenfield asks about the interactions between location and schooling. We did not emphasize these interactions because only four were significant. Nevertheless, the values that entered into these four interactions can be reported. For three—serial memory for words, serial memory for numbers, and double seriation—the difference between the schooled and nonschooled children in Lamas far exceeded the difference between the two groups of children living in Lima, a result that is opposite from that predicted by Greenfield. In serial memory for words, for example, the average difference between the schooled and nonschooled children in Lamas was 5.7 words, while it was 1.6 words in Lima. For serial memory for numbers, the corresponding differences were 3.1 and 1.3; for double seriation, the difference between scores was 1.29 in Lamas and .07 in Lima. In the fourth task, perceptual learning, both schooled and nonschooled children performed extremely well in Lamas, and the significant interaction was a result of this ceiling effect. Generally, then, the findings argue against Greenfield's suggestion that sampling bias entered into the selection of the schooled children of Lima.

We agree with Greenfield's suggestion that the question of who attends school in Lima is extremely complex. Unfortunately, funds were not available to allow us to interview more than a small sample of the parents of children who did and did not attend school. Because of this we were unable to relate the interview material statistically to the test data. However, we can find no evidence from our experience in the schools or neighborhoods to indicate that attendance is determined primarily by cognitive characteristics of the child. The major reasons for nonattendance at school in Lima appear, rather, to be those we have described. We should also point out that, although 85% of the children are registered for school, this does not mean that they will appear when school opens or that they will complete the first year.

In Lamas the situation is no less complex. Even factors such as degree of remoteness of the village are not related to the proportion of children who attended school. In some villages which are so remote they can be reached only by a half-day walk along jungle trails, the percentage of children attending school is high. In other more accessible villages, the percentage is low. Similarly, sex of the child does not have a consistent influence. Girls may be kept out of school because they must tend their younger siblings, while elsewhere boys may be kept out of school because they must assist their fathers on the family *chacra*. More information about the basis of school attendance clearly would be helpful.

Selection of Tasks

What tasks are we to choose in evaluating the influence of schooling on cognitive development? It seemed to us that we should not include material that is taught directly in school, but we should select tasks tapping aspects of memory, learning, and conceptualization that might be influenced by attendance at school. We did not seek to test the remarkable skill of young Quechua children in Lamas in finding their way through complicated jungle trails, nor of the rural children's ability to discriminate the markings of their family's pigs, chickens, and turkeys from among the many animals of other villagers. Rural children obviously learn a great deal from their everyday experience, as do city children, whether or not they attend school. But we could not hope to include the number of tasks that would be sufficient to encompass all of these abilities in a single study. Tasks were not selected by default; they were selected because they presumably were related to abilities that would be positively influenced by attendance at school. By using the same tasks in both environments and with both cultural groups, we were able to assess the generality of effects beyond a single environmental setting and cultural group.

Individual Differences

Finally, Greenfield indicates surprise that the effects of schooling should be as pervasive as those that were found. In responding to her comments, we should reiterate our findings regarding within-child variability in performance on the various tasks. If the degree of within-child variability were

comparable for schooled and nonschooled children, we would conclude that the higher means were due to relatively equivalent positive effects across all tasks for all of the children. What we found, however, was that the within-child variability of performance was greater for the schooled than for the nonschooled children. This indicates that a child who attended school did extremely well on some tasks, while the same child's performance on other tasks seemed to be relatively unaffected by attendance at school. Thus, although the average level of performance on all tasks was higher for the schooled than for the nonschooled children, the effects of schooling *on a particular task for an individual child* was highly variable. Because of the differential effects of attendance at school on different cognitive functions of the individual child, it is hard to attribute the mean differences to school children's improved testability or to better examiner-child rapport. What appears, instead, is that some children benefit from school in certain ways, while other children are affected in different ways. One of our next problems is to attempt to understand why this should be the case.

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A FURTHER NOTE FROM PATRICIA M. GREENFIELD[1]

The reply of Stevenson et al. is a useful appendix to their *Monograph*, providing clarification in a number of different areas. The additional data it contained made me aware of a problem in the way data were reported in the original *Monograph:* frequent use of analysis of variance without presenting group means. Because of this omission, it was, for example, impossible to know from the original *Monograph* on exactly which tests Mestizo children did better and on which Quechua. The full pattern of cultural differences, reported in the reply, indicates that language of testing is not the general factor explaining cultural differences, as I had hypothesized on the basis of selected means presented in the original. The absence of means also made it impossible to know from the original *Monograph* whether the significant interactions between location and schooling arose from larger effects of schooling in Lima or Lamas. In their response, Stevenson et al. tell us that the effect of schooling was larger in Lamas than Lima; this pattern militates against differential sampling bias as a factor in the results, as

[1] I would like to thank Amado Padilla, Department of Psychology, University of California, Los Angeles, for providing source material on the linguistic situation in Peru and discussing the issues involved in this reply.

the authors point out. Instead, it suggests verbal stimulation at home as the crucial factor, an explanation favored by the authors for other facets of their results. The reasoning behind the application of this idea to the schooling-location interactions goes as follows: According to the *Monograph*, both Quechuas and Mestizos rank higher on verbal stimulation relevant to education in Limas than in Lamas. Parents who report reading to children, attempting to teach them letters and numbers, and engaging them in social conversation receive high scores on this measure. Note the similarity of all but the last item to what is taught in school. It stands to reason that differences between schooled and unschooled children will be greater the more the school environment differs from the home environment and the child's out-of-school surroundings. This principle would appear to explain why, for example, schooling has been found to make a difference in the development of conversation in Senegal (Greenfield 1966) but not in the United States (Sigel & Mermelstein 1965). Because the home stimulation results indicate that Lamas parents provide less of what school teaches than do Lima parents, schooling should create a larger gap between schooled and unschooled children in Lamas than Lima, exactly what Stevenson et al. have found.

Language of testing is an extremely complex issue, more complex than I had realized at the time of my original commentary. While the authors argue convincingly that language of testing has not confounded the cultural factor in their results, the matter is much more complicated. According to my colleague Amado Padilla, a developmental psychologist recently returned from tenure as a Fulbright scholar in Peru, Quechuas and other Indians often transform themselves to Mestizo, and they do so as much by simple desire as by knowledge of Spanish. Thus, many people calling themselves Mestizo actually speak Quechua or some other Indian language as their first language. On the other hand, there are two major types of Quechua dialect, actually as distinct as two separate languages (Parker 1972), and many dialectical varieties within each type (Torero 1972), not necessarily mutually intelligible (Padilla, personal communication, 1978). Hence, a tester familiar with one Quechua dialect might not be able to communicate with a child speaking a different one. The inadvertent use of the wrong Quechua dialect in a testing situation may explain why Stevenson et al. find the performance of many Quechua children worse in Quechua.

In summary, the nature of the process by which an Indian becomes Mestizo would lead to systematically overestimating knowledge of Spanish on the part of Mestizos, while the existence of many distinct Quechua dialects would lead to systematically underestimating knowledge of Quechua on the part of the Quechuas. In terms of the cultural groups set up by Stevenson et al. for their study, the implications are twofold: (1) there is most likely some cultural overlap between the Quechua and Mestizo children, and (2) the Mestizo group is culturally quite heterogeneous.

Finally, and perhaps most important, Stevenson et al. say that use of Spanish as the language of testing does not communicate lack of respect for Quechua culture in places where Quechuas already consider Spanish more useful and prestigious than Quechua. In effect they are saying that it is permissible to ignore the Quechua language where the Quechua people already lack respect for their own culture. But lack of self-respect is a mark of oppression. In the case of the Quechua Indians, the roots of the oppression lie in the Spanish conquest. In the United States we have seen oppressed minorities struggle to regain self-respect through a process of revaluing their own cultures and, in the case of Spanish-speaking minorities, their own language. In this type of situation psychologists doing research have a choice between participating in or resisting the process by which relatively powerless minority peoples come to value the majority culture more than their own. Where the minorities have their own languages, as in Peru, the choice of a testing language can have a scientific rationale, but it cannot be politically neutral.

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