1

INTRODUCTION: PSYCHOLOGY AND ANTHROPOLOGY I

The problem is to invent what has recently been nicknamed "outdoor psychology" (Geertz 1983). The book is an inquiry into conditions that would make this possible. The conclusion: that contemporary theorizing about social practice offers a means of exit from a theoretical perspective that depends upon a claustrophobic view of cognition from inside the laboratory and school. The project is a "social anthropology of cognition" rather than a "psychology" because there is reason to suspect that what we call cognition is in fact a complex social phenomenon. The point is not so much that arrangements of knowledge in the head correspond in a complicated way to the social world outside the head, but that they are socially organized in such a fashion as to be indivisible. "Cognition" observed in everyday practice is distributed – stretched over, not divided among – mind, body, activity and culturally organized settings (which include other actors). Empirical support for this proposal has emerged recently from research exploring the practice of mathematics in a variety of common settings. These studies converge towards a view that math "activity" (to propose a term for a distributed form of cognition) takes form differently in different situations. The specificity of arithmetic practice within a situation, and discontinuities between situations, constitute a provisional basis for pursuing explanations of cognition as a nexus of relations between the mind at work and the world in which it works.

The problem and the project

The Adult Math Project (AMP), an observational and experimental investigation of everyday arithmetic practices in different settings, has provided a basis for the analytic and theoretical development of such an

argument. It began several years ago with simple descriptive questions about arithmetic practice: How does arithmetic unfold in action in everyday settings? Does it matter whether it is a major or minor aspect of ongoing activity? Are there differences in arithmetic procedures between situations in school (e.g. taking a math test) and situations far removed from school scenarios (in the kitchen or supermarket)? To search for answers we undertook a number of closely related studies: of "best-buy" arithmetic calculations in the course of grocery shopping in the supermarket; a simulation experiment on these same calculations; an extensive set of arithmetic tests; and observations across time, settings and activities of dieting cooks in their kitchens; and of people managing the flow of money through their households.

More general questions focused on relations between arithmetic use and its sociocultural locus in time and space. Success at problem solving, the procedures employed, and the problems themselves, varied for the same people in different contexts. For example, a teacher in an arithmetic lesson might pose a word problem for the children: "Becca has four apples and Maritza has five apples, how many apples in all?" The answer to this "apple" problem and another observed in the supermarket is "nine." But here is the problem as it appeared in the market, observed during a grocery-shopping expedition. The shopper was standing in front of a produce display. As she spoke she put apples, one at a time, into a bag. She put the bag in the cart as she finished talking:

> There's only about three or four [apples] at home, and I have four kids, so you figure at least two apiece in the next three days. These are the kinds of things I have to resupply. I only have a certain amount of storage space in the refrigerator, so I can't load it up totally . . . Now that I'm home in the summertime, this is a good snack food. And I like an apple sometimes at lunchtime when I come home.
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> *(Murtaugh 1985b: 188)*

This is a problem in several senses other than those posed by a conventional math "word problem." There are several plausible answers – 9, 13, 21. It appears that the problem was defined by the answer at the same time an answer developed during the problem, and that both took form *in action* in a particular, culturally structured setting, the supermarket. We also observed this shopper's math practices in other settings, one of which was a test-like format borrowed from school arithmetic. A week after the grocery-shopping expedition she worked out a large number of math problems during a comprehensive survey of her knowledge of school arithmetic (e.g. integer, fraction, decimal and negative number arithmetic). Her activity in this setting offered little

useful information about her success at math in the supermarket, about the kinds of problems encountered there, or about the procedures she devised for resolving them.

The AMP investigated arithmetic practices in a variety of settings to gain a different perspective on problem solving from that found in school or laboratory. The research focused on adults in situations not customarily considered part of the academic hinterland, for no one took cooking and shopping to be school subjects or considered them relevant to educational credentials or professional success. AMP "experts" were grocery shoppers rather than physicists and none of the novice learners beginning a new dieting program was a college sophomore. In order to observe variation in (still ordinary) cognitive activity the 35 participants were chosen to reflect broad differences in schooling, age, time since schooling was completed, family size and income. We began with participant observation, analysis of the settings for their activities, and description of the organization of the activities within which we hoped to catch glimpses of arithmetic in process. All were interviewed, observed in action, and asked occasionally to vary their everyday activities in specified ways. And we asked them to endure our experimental and test-like attempts to learn about their current knowledge of school and other arithmetic procedures.

Several years of exploration of arithmetic as cognitive practice in everyday contexts had led to a kernal observation from which the argument follows. The same people differ in their arithmetic activities in different settings in ways that challenge theoretical boundaries between activity and its settings, between cognitive, bodily, and social forms of activity, between information and value, between problems and solutions.

The empirical and theoretical characterization of situationally specific cognitive activity – what it is, and why – is, therefore, the central project of the book. This subsumes a number of analytic questions. Is the absence of school-problem formations in everyday math activity to be interpreted as "the absence of school mathematics," the construction of some other mathematics, the inadequate or incomplete use of school arithmetic? How does schooling shape arithmetic activity in everyday situations? What model might best capture the unfolding character of problem-solving processes *in situ*? What constitutes an adequate, general theoretical formulation of situationally specific cognitive activity, of mundane settings, and of activity in such settings? Resolutions to these questions will be pursued throughout the book.

It may seem odd that the work has been concentrated on participants

and activities rather far removed from school and laboratory, and yet focused on arithmetic – school subject and exemplar of beliefs about the rational, scientific mind. Both the sites and content of the research reflected our assumptions about the cultural construction and distribution of mathematical knowledge. It seemed crucial to take into account the web of relations among academic cognitive theory, the organization of schooling, the socialization experiences of people in school, and their theories (as alumni) of cognition, schooling, and "proper" arithmetic practice. This seemed especially important because research on the ongoing activities of AMP participants suggested that our understanding was entangled with institutions and dilemmas which, for purposes of cognitive research, are usually treated as if they had no direct bearing on each other.

One example of these intricate ties is a widely shared belief that "scientific thought" is a proper yardstick with which to measure, diagnose and prescribe remedies for the "everyday thought" observed in experiments and schooling. This belief has long historical roots (see chapter 4) that have influenced cognitive theory, the institutional form of schooling, and folk theories alike. Further, Western culture links science, schooling, and everyday practice in a hierarchical ordering of the kinds of thinking and knowledge supposed to be characteristic, respectively, of professional experts, "laypersons" (a term that should give pause), and "just plain folks" (jpfs).[1] There are influential networks of communication between academic psychology, the school establishment that educates both laypersons and scientists, and the alumni of these institutions. These networks ensure that psychological theories affect, though not reliably, both educational theories and educational practice, which in turn shape and are shaped by the beliefs of students. Alumni of schooling are the objects whose after-(school)-life is theorized about by psychologists and educators, who at the same time *are* the theorists, the teachers, and the parents of children in school.

At the center of this cultural web lies the concept of learning transfer, reflecting widely shared assumptions about the cognitive basis of continuity of activity across settings. Conventional academic and folk theory assumes that arithmetic is learned in school in the normative fashion in which it is taught, and is then literally carried away from school to be applied at will in any situation that calls for calculation. There are conventional opinions about how well this works: "most kids fail to learn in school so the world must be made up of un-numerate people who cannot multiply or divide," or "school arithmetic algorithms are used routinely in the everyday lives of school alumni (there is

no other kind of math to use)." The most common view distinguishes successful alumni from the unsuccessful, attributing constant and skilled use of school knowledge to the former, and rare, often erroneous, use to the latter. None of these propositions is given support by AMP research. Nor would one expect them to be if arithmetic practice were in any serious sense constructed *in situ*.

All of this suggests that schooling is implicated in any analysis of arithmetic activities in everyday practice. But there is a further implication: to the extent that the interconnections among cognitive theory, schooling and everyday practice are not taken into account as such, they form a major impediment to penetrating a cultural edifice whose monumental character has, arguably, prevented anything *but* confirmation of conventional, socially and culturally organized beliefs about cognition. One remedy for this state of affairs is to focus studies of cognition on situations as far removed from school and laboratory as possible, not in order to achieve the impossible feat of neutralizing their influence on practice, but to refract it from a different angle while keeping relations with schooling continually in view. The other is to approach and analyze *cognitive theory* as a routine, unexceptional aspect of Western culture.

There is still pending the question of why arithmetic is the subject matter of these studies. In earlier research on relations among educational forms, cognitive theory and everyday practice, with Vai and Gola tailors' apprentices in Liberia (Lave 1977, 1982, in preparation: Reed and Lave 1979), the focus on arithmetic was initially motivated by methodological concerns. Math provided a basis for comparison, since both apprentices and school children learned and used it in their everyday educational activities. But the longer I have pursued the matter, the richer the reasons for continuing to do so. Briefly, arithmetic is an accepted topic for research within cognitive psychology, hence observational research in settings other than laboratories offers opportunities to compare results and raise questions about the ecological validity of experimental studies. Arithmetic is a sympathetic "medium" for the researcher who wishes to study activity in open-ended situations, for it has a highly structured and incorrigible lexicon, easily recognizable in the course of ongoing activity. For the same reason it is more easily analyzed in the absence of complete process data. And it allows us to focus on activity whose specific presence in the web of relations among academic psychology, school organization and folk models, was as explicitly available for examination as possible.

Another, powerful, reason for focusing on math lies in relations

between practices attributed to "lay" cognition, the practices of academicians interested in cognition, and the theory behind the practices behind the attributed cognitive characteristics. The participants of the AMP inhabit a world conventionally presumed to be populated by faulty mathematicians – a world in which the importance and ubiquity of math has not been assessed but is never questioned. Yet experimental tasks call for mathematical and logical problem solving as a central, ongoing activity. In this context the central theoretical metaphor is a computational one in which the mind is supposed to reflect, represent and hypothetically to operate on, rather than interact with, the world (de la Rocha 1986, especially chapter 2). Arithmetic practice in everyday life is of interest beyond its immediate scope and value to practitioners because of these relations between theory, practice and the attribution to subjects' practice of a common set of principles. One way to rethink models of mind is to reexamine cognitive processes that have been infused with a specific theoretical meaning by contemporary cognitive theory, as has mathematics. In short, a different description of the phenomenon may provide grounds for pursuing a different problematic of cognition altogether.

A dilemma of shared dilemmas

Cognitive psychology and cognitive anthropology have elaborated the study of how people think on the basis of, among other things, fundamental assumption about the nature of culture, the social world, and their relations with cognition. There may be no reason to review these assumptions unless the main task, the investigation of cognition, is hampered by their conventional formulations. The latter situation has developed in the last 15 years, as some psychologists have begun to doubt the ecological validity of experimental findings and to ask what thinking is like in the pervasive contexts of people's lives (Bronfenbrenner and Mahoney 1975; Neisser 1976; Cole, Hood, and McDermott 1978; Bronfenbrenner 1979). For their part, cognitive anthropologists have long expressed concerns about the psychological validity of their analyses of cultural category systems (e.g. Burling 1964; Romney and D'Andrade 1964), and more recently have questioned the conventional uses of linguistic models for cognitive anthropology in general (Dougherty and Keller 1982). Assumptions about cultural and cognitive uniformity have been questioned as well.

In the mid-1970s, faced with these difficulties, cognitive and educational anthropologists began to look to cognitive science, which offered increasingly sophisticated formal models of language, logic and problem solving (Quinn 1982), while cognitive scientists recognized that anthropologists employed a method which could lead to detailed knowledge of "real life" activities and situations. Given increasingly cordial suggestions that each might contribute to solutions of the problems of the other, there is reason to examine critically the degree to which either discipline is in a position to illuminate those complementary concerns. I take a skeptical view, given the difficulty of challenging an entrenched division of labor.[2] However more importantly, those who have worked within the culture and cognition paradigm, and within cognitive psychology and cognitive anthropology more broadly, *share* assumptions about culture, cognition and their relations too strongly to offer each other solutions to the dilemmas they face. It appears, indeed, that major dilemmas as well as assumptions are common to both.

The shared position (assumptions, forms of explanation, and even, in broad terms, method) is a functionalist one:[3] very briefly, society is characterized as a set of macrostructures in place, a *fait accompli* to be internalized by individuals born into it. Consensus – shared norms, values and culture more generally – is the foundation of social order. Degrees of consensus define social boundaries of different levels of inclusiveness. Cultural transmission, or socialization, is clearly central to achieving such consensus, and is the crucial relation between society and the individual. A duality of the person is inherent in this view. Articulated plainly by Durkheim (1915; Durkheim and Mauss 1963) and Levy-Bruhl (1910), it is implicit in the logic of cognitive studies today. Thus, thinking is said to have an emotional component, social in origin, and a cognitive–rational, individual one; their weighting in the person is a reflection of the degree to which collective life dominates the individual. On the face of it this proposition may not be immediately recognizable as a feature of cognitive theorizing, perhaps because its corollaries are more salient than the original proposition. Today, for example, it is likely to be assumed that if ongoing activity consists of problem solving – "individual, rational, cognitive" – it is not necessary to address the possibilities that it is culturally and socially structured, primarily expressive of feelings, or part of socially contextualized experience in ways that require theorizing, empirical description, or analysis. The experiment as a form of investigation customarily reflects

these assumptions as does the very category "information processing."[4]

More specifically, functional theory treats processes of socialization (including learning in school) as passive, and culture as a pool of information transmitted from one generation to the next, accurately, with verisimilitude, a position that has created difficulties for cognitive psychology as well as anthropology. Neither discipline appears to be theoretically equipped to elaborate a theory of active social actors, located in time and space, reflexively and recursively acting upon the world in which they live and which they fashion at the same time.

Functional theory underlies the web of relations between academic, novice and jpf "worlds." In this theory, duality of the person translates into a division of (intellectual) labor between academics and "the rest" that puts primitive, lower class, (school) children's, female, and everyday thought in a single structural position *vis-à-vis* rational scientific thought (see chapter 4). Functional theory arose in the early nineteenth century as an argument of the new industrial bourgeoisie against aristocratic privilege in Great Britain (Cooter 1979), an argument that if all individuals were given equal opportunities to advance in life, those who were superior physically, mentally and morally would naturally rise to the top. Those who lacked these qualities would stay where they justly belonged. Schooling, and relations that are assumed to hold between schooling, the academy, and the world of work, reflect this belief in a meritocracy. Functional theory permeates rationales, explanations, and the organization of schooling in American society, and imbues much of anthropological, educational, and psychological theory with its particular logic (cf. McDermott and Goldman 1983; Apple 1979). In particular, it is enacted in schools by their claim to treat all children alike (cf. Varenne and Kelly 1976; Bourdieu 1973) and its view that unequal ranking is an epiphenomenon of differential merit.

The functionalist sociology of education has been elucidated too thoroughly to require rehearsal here. But it may not be as well understood that the functionalist position contains a theory of learning: in particular, that children can be taught general cognitive skills (e.g. reading, writing, mathematics, logic, critical thinking) *if* these "skills" are disembedded from the routine contexts of their use. Extraction of knowledge from the particulars of experience, of activity from its context, is the condition for making knowledge available for *general* application in all situations. Schooling reflects these ideas at a broad organizational level, as it separates children from the contexts of their

own and their families' daily lives. At a more specific level, classroom tests put the principle to work: they serve as the measure of individual, "out of context" success, for the test-taker must rely on memory alone and may not use books, classmates, or other resources for information. Arguably examinations are also condensed, symbolic, ritual ordeals which inculate the essence of the theory.

Cognitive psychology accounts for stability and continuity of cognitive activity across settings through the psychological mechanism of learning transfer. That is, knowledge acquired in "context-free" circumstances is supposed to be available for general application in all contexts, widely transportable but relatively impervious to change in the course, and by the process, of travel and use. The central role of learning transfer reflects the functionalist assumption of literal culture transmission that informs broad conceptions of socialization and more specifically, the conceptualization of relations between school and everyday practice. In sum, even this short survey of the general functional model of cognition, culture, continuity and the social world confirms that there are strong, common theoretical assumptions in cognitive studies in psychology and anthropology. A discussion of their contemporary dilemmas will also show common patterns of concern across disciplines.

Cognitive anthropology has traditionally applied linguistic models, notably classical formal semantics, to classificatory paradigms of general cultural knowledge (e.g. kinship, plant, and color terminologies), an interest with direct roots in early twentieth-century functionalism. This theory came under critical analysis when cognitive anthropologists raised questions about relations between cultural knowledge and actors' cultural practice, one aspect of the problem of intracultural variation. Pelto and Pelto (1975) argued that:

> the predominant tendency in anthropological . . . theory-building continues to be made up of constructions reflecting fundamental assumptions of cognitive homogeneity and behavioral sharing. *(1975: 6)*

They suggest that the use of quasi-linguistic models, "based on a mentalistic meta-theory of human behavior" (1975: 7) has contributed to uniformist views and a strong penchant for treating culture in the same terms as language, concluding that:

> the monolithic view of behavioral causation that makes culture the cause of culture – with perpetuation of cultural patterns neatly through the generations by means of child training and other socialization – must be discarded. *(1975: 10)*

Cognitive psychologists have also espoused simplifying assumptions of cultural uniformity. Anthony Giddens, a social theorist who persistently raises issues about conventional conceptions of social actors and their relations with action, structure and social systems, has pointed out that:

> It is clear that much work on the psychological development of the individual is deficient as an account of socialization, in so far as the overriding focus is upon the differentiation of personality within an undifferentiated "society." This is true also in some considerable degree of the theory that has long dominated child psychology in respect of cognitive development: that associated with Piaget. *(1979: 129)*

The Laboratory of Comparative Human Cognition (LCHC 1981) has made the same point in relation to cross-cultural research on cognitive style.[5] But they are exceptional in a field not known for its self-critical views (see also Bronfenbrenner 1979: 258), perhaps because the problems raised by such critics are so easily avoided merely by honoring conventional limitations on subject matter.

The concept of cultural uniformity reflects functionalist assumptions about society as a consensual order, and cultural transmission as a process of homogeneous cultural reproduction across generations. It has served as a mandate to treat culture in cognitive studies as if it were a constant, as if nothing essential about thinking would be disturbed if its effects were controlled experimentally. This is surely one means by which cognitive psychology has kept within the bounds of the division of labor between the study of the individual and anthropological studies of culture and social organization. For such a strategy legislates away major questions about social diversity, inequality, conflict, complementarity, cooperation and differences of power and knowledge, and the means by which they are socially produced, reproduced and transformed in laboratory, school and other everyday settings. (These same questions are more difficult to avoid when the arena of investigation is the lived-in world.) It is worth keeping in mind that the specific character of this division of labor strongly influences theoretical speculation about the sources of continuity of activity, as well as methodological questions about the ecological validity of experimentation.

Indeed, validity is another of those issues that has been raised in both cognitive anthropology and psychology, though in slightly different guises. In the late 1960s, cognitive anthropologists began to worry about the psychological validity of their componential analyses of semantic categories. The problem is closely related to the question of intracultural variation, for it depends on recognition that people within a single culture have various means for classifying the same things (e.g. Wallace