job, a routine event in the course of their daily, institutional lives. This practical concern makes the committee sensitive to the nature of the particular case before them and to its particular outcome. The committee is faced with a specific problem that demands an immediate, concrete solution, and demands it now. They are concerned with this student, this placement, at this time. They are not concerned with generating the range of all possible actions that exist in the abstract for the sake of doing so. Thus, the members of the committee have a pragmatic not a theoretical motive for their actions (Schutz, 1964; Scribner, 1977). Their project is to get this work done, to settle this case, so that they can get back to other practical projects that are piling up on their desks or that await them in their classrooms.

In this respect, the decision-making action of the committee is submerged in the other practical activities confronting the committee members during the course of their daily, institutional lives. What appears to be the project from the point of view of rational action (making decisions) turns out to be a component part of more inclusive practical projects. The manifest cognitive task is embedded in an ongoing project of action.

What occurs here is a shift in perspective—really a shift in metaphor—for viewing organizational behavior. When organizational behavior is examined from the perspective of the rational model, one sees "acts" and "choices," and searches for "reasons" and "motives." When organizational behavior is examined from the perspective of the organizational process perspective, one sees end results, and looks for the routine practices that constitute them. As a consequence of this shift in perspective, organizational behavior can be understood less as deliberate choice and more as end results, or as consequences of organizations functioning according to standard operating procedures. For this case study, the shift in metaphor means that the placement of a student is more a function of organizational procedure than of organizational choice. The placement of a student in a special education program is not so much a decision made as it is an enactment of routines.

From:
Rogoff, B. & J. Lave (Eds.) *Everyday Cognition: its development in social context.* © Harvard University Press, 1984.

3. The Dialectic of Arithmetic in Grocery Shopping

Jean Lave
Michael Murtaugh
Olivia de la Rocha

The ubiquity and unremarkable character of routine activities such as grocery shopping qualify them as apt targets for the study of thought in its customary haunts. For the same reasons, these activities are difficult to analyze. Such an enterprise faces thorny theoretical as well as methodological problems, for it depends on an integrated approach to everyday activities in context (Lave, in preparation). We address these general problems here mainly by example, focusing specifically on a familiar social institution, the supermarket, which is a highly structured environment for the exercise of a clearly defined activity, grocery shopping.

In recent years there has been increasing concern about the ecological validity of experimental research within cognitive and developmental psychology (e.g. Bronfenbrenner & Mahoney, 1975; Neisser, 1976; Cole, Hood & McDermott, 1978; Bronfenbrenner, 1979). There is speculation that the circumstances that govern problem solving in situations which are not prefabricated and minimally negotiable differ from those that can be examined in experimental situations. The fundamental questions raised by such speculation demand a more radical change in the nature and scope of theoretical and empirical research than has, perhaps, been generally recognized.

However, in an attempt to develop an adequate perspective from which to consider cognition in context, the analysis of data on supermarket arithmetic has been initiated as simply as possible, with a series of five common-sense propositions about the contextualized nature of human activity. These have provided guidelines

for the empirical study, which in turn suggested more strongly the outlines of a systematic theoretical position. First, arithmetic activity has formal properties which make it identifiable in the flow of experience in many different situations. Second, the enormous productivity of script theory (Schank & Abelson, 1977) and the organization of environments in relation to scripted activities (e.g. the drugstore, fourth grade classroom) suggest that the human organization of activity gives primacy to segments on the order of ten minutes to two hours. Arithmetic problem-solving is thus smaller in scope than the units of activity in which people organize and think about their activities as wholes. It follows from these two assumptions that arithmetic activity should be strongly shaped in form, outcome, and meaning by the broader scope of activity and setting within which it occurs. It should also be shaped by the past experience and beliefs of the problem solver about what that individual is doing, what should happen in the course of doing it, and what the setting is in which it is taking place. Finally, an "integrated" approach to arithmetic activity in context has two meanings: the integral nature of activity in relation with contexts, and the mutual interdependence of mental and physical activity. Both meanings of *integration* prescribe a research methodology whereby data should be gathered directly about people-doing-in-their-usual-contexts.

These propositions do not constitute a theory of activity-in-setting, for they do not specify relations between activity and setting or between the individual and the social order within which the world is actively experienced. In their present form, however, they suggest a series of analytic steps for the elucidation of the case study. Grocery shopping was selected because it is an activity which occurs in a setting specialized to support it: the supermarket. Taking the supermarket as the arena for grocery-shopping activity, the analysis focused on the question: What is it about grocery shopping in supermarkets that might create the effective context for what is construed by shoppers as "problem-solving activity"? What are the general characteristics of problem solving when something happens in the course of shopping that appears problematic to the shopper? And how does the character of problem solving within grocery shopping specifically affect the nature of arithmetic activity?

To answer these questions, the Adult Math Skills Project was designed to investigate arithmetic decision-making processes during grocery shopping. This involved extensive interviewing, observation, and experimental work with twenty-five adult, expert grocery shoppers in Orange County, California. Detailed, transcribed observations of shopping preparation, a major shopping trip, and storage and use of the purchased foodstuffs over a period of weeks represented one dimension of the work. A comparative dimension involved a sampling of arithmetic practices in several settings by these same individuals. The Orange County residents varied in age from twenty-one to eighty, in income from $8,000 per family to $100,000, and in education from eighth grade to an M.A. degree. Twenty-two were female, and all were native speakers of English whose schooling took place in United States public schools.

The data were obtained through participant observation. Before entering the supermarket, shoppers strapped a tape recorder over their shoulder and were asked to "think out loud" while proceeding through the store, because the two anthropologists accompanying them were interested in learning about their shopping procedures, whatever they might be. As a shopper walked through the store, one researcher maintained a running conversation with the shopper. This approach grew out of pilot work using both more and less active methods, which indicated that shoppers feel more comfortable describing their behavior as part of a conversation than simply as a monologue. The conversational approach also made it possible to clarify many of the shoppers' comments and other aspects of the shopping environment that would otherwise not be clear in a taped recording.

The researchers also sought information about influences on the shopping decisions that the shoppers themselves might not volunteer. Once an item was selected, the shopper was asked about other items present which had not been mentioned. These questions generated much additional information. In all cases the researcher was careful not to interpret the situation for the shopper but rather to clarify the shopper's behavior for the record. Since the attempt to exercise high ethnographic standards could not eliminate the interaction between actor and observer, rather than ignoring it, the analysis takes it into account.

The Constructs of Setting, Arena, and Context

The conceptualization of setting derived from Barker's view that "the environment of behavior is a relatively unstructured, passive,

probabilistic arena of objects and events upon which man behaves in accordance with the programming he carries about within himself. . . But when we look at the environment of behavior as a phenomenon worthy of investigation for itself, and not as an instrument for unraveling the behavior-relevant programming within persons, the situation is quite different. From this viewpoint the environment is seen to consist of highly structured, improbable arrangements of objects and events which coerce behavior in accordance with their own dynamic patterning" (1968:4).

For Barker, a segment of the environment is sufficiently coherent to be identified as a behavior setting if little of the behavior found in the setting extends into another setting, if there is sufficient sharing of personnel within that setting but limited sharing with related settings, if behaviors in the setting are closer to each other in time and space than to behaviors outside the setting, and if there is greater sharing of objects and modes of behavior in subparts of the setting than between this setting and related ones. Barker and Wright (1954) operationalized these criteria in undertaking to describe all of the settings of a year's behavior in a small town in Kansas. The goal of their monumental effort was not to produce an ecological description of a town but to account for the behavior of its inhabitants. They argued that for each setting there is a standing pattern of behavior, which can be thought of as a set of norms prescribing appropriate behavior. They often referred to these literally as "rules of the game." Further, the setting and the patterned sequence of behavior taking place in the setting are similar in structure, or "synomorphic."

This conceptualization of setting, with its ideal of structural fit, or synomorphy, provides a promising beginning for theorizing about activity, setting, and their interrelations. But it assumes a unidirectional, setting-driven relation between activity and setting, which reduces activity to a passive response to the setting. Correspondingly, analysis of the internal organization of activity becomes impossible. Barker's conceptualization also precludes analysis of the relation between behavior and setting, because only one of the two poles of this relation is available for analysis in its own right. He recognized the existence of a more complicated state of affairs than his model can encompass, remarking that "a great amount of behavior in Midwest is concerned with creating new milieu arrangements to support new standing patterns of behavior,

or altering old milieu features to conform to changes in old patterns of behavior" (1968: 32). But his model has no mechanism in it that would account for these possibilities.

The obvious way to reject the view that settings are objective entities, independent of observer and participant alike, is to place new emphasis on Barker's view that the elements which create behavior settings change from setting to setting, and to reinterpret settings in phenomenological terms as the constructions of participants (cf. Laboratory of Comparative Human Cognition, 1981). But if setting is not an objective phenomenon, it is hard to account for Barker's enumeration and description of behavior settings in a town in Kansas. This impressive empirical evidence supports the theory of settings as objective entities and casts doubt on the feasibility of a strictly phenomenological alternative. This poses a dilemma, for which the time-honored solution is appropriate: both views are partially correct, though neither is complete.

Certain aspects of behavior settings have durable and public properties. The supermarket is such a durable entity—a physically, economically, politically, and socially organized space-in-time. In this aspect it may be called an "arena" within which activity takes place. The supermarket as arena is the product of patterns of capital formation and political economy. It is not negotiable directly by the individual. It is outside of, yet encompasses the individual, providing a higher-order institutional framework within which setting is constituted. At the same time, for individual shoppers the supermarket is a repeatedly experienced, personally ordered and edited version of the arena. In this aspect it may be termed a "setting" for activity. Some aisles in the supermarket do not exist for a given shopper as part of his setting, while other aisles are multifeatured areas to the shopper who routinely seeks a particular familiar product.

The relationship between these newly differentiated units of analysis, "arena" and "setting," is reflected in the ordinary use of the term *context*. What appear to be contradictory features of meaning may be accounted for by recognizing that context refers to a relationship rather than to a single entity. For on the one hand, context connotes an identifiable, durable framework for activity, with properties that transcend the experience of individuals, exist prior to them, and are entirely beyond their control. On the other hand, context is experienced differently by different individuals.

The supermarket study distinguished between the imposed constraints of the supermarket as arena and the constructable, malleable nature of the setting in relation with the activity of particular shoppers. Because a social order and the experience of it mutually entail one another, there are limits on both the obdurate and malleable aspects of every context.

The Construct of Activity

In dealing with the active individual in interaction with her context, the study drew on the concept of activity that has been developed in Soviet psychology. Activity theory, in contrast with the setting-dominated view of interaction, addresses the organization intrinsic to activity. According to Leontiev, activity "is not a reaction or aggregate of reactions, but a system with its own structure, its own internal transformations and its own development" (Wertsch, 1981:255).

Leontiev defined three levels of activity. The highest level is that activity which occurs in relation to motive, or "energizing force" (e.g. play, work, formal instruction). Leontiev gave hunger as an example of a motive: "This provides the energizing force behind an organism's activity, but at this level of abstraction nothing is said about the goals or ends toward which the organism is directed." This level appears too abstract to relate to the person-acting-in-context approach of the supermarket study. Moreover, work and play refer to cultural categories of activity rather than to specific activities in context. The remaining levels in the theory of activity fit more easily with the units of analysis in the study. The second level is an action defined by its goal (e.g. solving an arithmetic problem, finding the shelf in the supermarket with olives on it). The third level is that of operations, which contrasts with the action level since "certain conditions in the environment influence the way an action is carried out without giving rise to consciously recognized goals or subgoals" (Wertsch, 1979:86–87). Examples include shifting car gears or putting a can of olives in the grocery cart.

The wholistic nature of activity in context is shown in Leontiev's strong emphasis on the derivation of meaning by actors from the multilevel activity context. Meaning is located in relations between the levels of activity and action, on the one hand, and action and

operation, on the other. Sense and meaning are distinguished, which parallels the distinction between personal setting and public arena in the supermarket study. For Leontiev, sense designates personal intent, as opposed to meaning, which is public, explicit, and literal. Sense derives from the relations of actions and goals to motivated (higher order) activities of which they are a particular realization. Furthermore, "the goal of one and the same action can be consciously realized in different ways, depending on the connections it has with the motive of the activity" (Wertsch, 1981:264–265).

This same relational emphasis operates "downward" as well in the system of activity, at the action/operation interface. Zinchenko, for example, designed tasks so that the "same" arithmetic problems were treated as conscious actions in one experimental session and as operations in the course of inventing math problems in another session. The arithmetic stayed the same in formal mathematical terms, while its role in the subject's activity changed. This change, according to Zinchenko, had clear effects on the subjects' memory of the arithmetic: "Material that is the immediate goal of an action is remembered concretely, accurately, more effectively, more durably. When related to the means of an action (to operations) the same material is remembered in a generalized way, schematically, less effectively, and less durably" (Wertsch, 1981:272). These results support the view that to comprehend the nature of arithmetic activity as a whole requires a contextualized understanding of its role within that activity. Indeed, they provide a strong argument for the necessity of analyzing any segment of activity in relation to the flow of activity of which it is a part.

But neither Soviet psychology nor Barker's functionalist brand of setting determinism addresses the nature of the articulation between activity and setting. The supermarket study distinguished between a supermarket as an arena, which is a non-negotiable, concrete realization of a political economy in place, and as a personal setting of grocery-shopping activity. The setting both is generated out of grocery-shopping activity and at the same time generates that activity. In short, activity is dialectically constituted in relation with the setting. For example, suppose a shopper pauses for the first time in front of the generic products section of the market, noting both the peculiarly plain appearance of the products, divested of brand names and other information to which the shopper

is accustomed, and the relatively low prices of these products. This information provides a potential new category of money-saving strategies, which may be added to an existing repertoire of such strategies. This in turn leads the shopper to attend to the generic products on subsequent shopping trips. The setting for these future trips, within the supermarket as arena, is thereby transformed. And any change in the setting within the arena transforms the activity of grocery shopping. Neither setting nor activity exists in realized form, except in relation with each other; this principle is general, applying to all levels of activity-setting relations.

The Supermarket as Arena and Setting

The arena of grocery shopping is the supermarket, an institution at the interface between consumers and suppliers of grocery commodities. Many of these commodities are characterized in consumer ideology as basic necessities, and the supermarket is the only avenue routinely open for acquiring them. Typical supermarkets keep a constant stock of about seven thousand items. The arena is arranged so that grocery items remain stationary, in locations assigned by suppliers and store management, while shoppers move through the store, pushing a cart, searching for the fifty or so items they buy on a weekly basis. The arena may be conceived of as an icon of the ultimate grocery list: it is filled with partially ordered sequences of independently obtainable objects, laid out so that a physical progression through the entire store would bring the shopper past all seven thousand items.

A shopper's progress through the arena, however, never takes this form. The supermarket as "list" and the shopper's list are of such different orders of magnitude that the fashioning of a particular route through the market is inevitable. Part of what makes personal navigation of the arena feasible is the ordered arrangement of items in the market and the structured nature of purchase intentions of the shopper. The setting of grocery-shopping activity is one way of conceptualizing relations between these two kinds of structure. It may be thought of as the locus of articulation between the structured arena and the structured activity.

For example, the arrangement of the arena shapes the setting, in that the order in which items are put into the cart reflects their location in the supermarket rather than their location in any of the

activities from which shoppers routinely generate their lists (e.g. meal planning, cupboard inventory). Yet the setting is also shaped by the activity of the shopper. Without babies and dogs, a shopper may routinely bypass the aisles where diapers and dogfood are located. Expectations that the chore ought not take more than an hour shape the amount of time that shoppers allocate to each item and hence the degree of effort and structure to their search. These searches in turn have articulatory implications for the arena, which is created, as in packaging design and display of products, in response to the character of individual search structures.

The character of the resulting synomorphy is part of what is meant by "setting." The articulatory nature of setting is to be stressed. A setting is not simply a mental map in the mind of the shopper. Instead, it has simultaneously an independent, physical character and a potential for realization only in relation to shoppers' activity. All of this together constitutes its essential character.

An example from the supermarket illustrates the mutual relations between setting and activity, such that each creates the other, both coming into being at the same time. A shopper and the observer walk toward the frozen enchilada case. Until the shopper arrives in front of the enchilada display, it is as if she were at not just a physical but a cognitive distance from the enchiladas. In contrast, she and the enchiladas, in each other's presence, bring into being an entirely different quality to the activity:

Shopper (speaking hesitantly, eyes searching the shelves to find the enchiladas): Now these enchiladas, they're around 55 cents. They were the last time I bought them, but now every time I come . . . a higher price.

Observer: Is there a particular kind of enchilada you like?

Shopper: Well, they come in a, I don't know, I don't remember who puts them out. They move things around too. I don't know.

Observer: What is the kind you're looking for?

Shopper: Well, I don't know what brand it is. They're just enchiladas. They're put out by, I don't know. *(Discovers the display of frozen Mexican dinners.)* Here they are! *(Speaking vigorously and firmly.)* They were 65 the last time I bought them. Now they're 69. Isn't that awful?

Here the shopper's demeanor before and after she locates the enchiladas points to the relevant contrast. There is, on the one

hand, her vague characterization of the product she intends to purchase before she locates it and, on the other hand, her precise description and vigorous tone once she has it in sight. This difference — between activity and setting caught in transit (before she finds the enchiladas) and activity in setting (as she finds them) — is ubiquitous in the data, and it illustrates what is meant by the integral and specific character of particular activities in particular settings.

Grocery-Shopping Activity

Grocery-shopping activity is made up of relatively discrete segments, such as the enchilada purchase. The shopper stops in front of one display after another and goes through a process of deciding which item to transfer from shelf to cart. In most cases it is possible to face the display, locate an item, and take it from the shelf without moving more than a foot or two from the initial position.

Within a particular shopping activity segment, size and brand are taken into account, in that order, in making decisions, while price and quantity are considered at the end of decision processes (Murtaugh, 1983). But the complexity of the search process varies a great deal across items. Many selections are made without apparent consideration, as part of the routine of replenishing supplies. More often than not, however, shoppers produce an account for why they routinely purchase a particular item rather than an available alternative. This use of "old results" suggests that part of the move from novice to expert grocery shopper involves complex decision processes, a few at a time, across many trips through the market.

Much of the decision making which occurs as shoppers place themselves in physical relation with one display after another is of a qualitative nature. Shoppers care about the taste, nutritional value, dietary implications, and aesthetics of particular groceries. In relation to this qualitative decision-making, commodity suppliers and store management respond with large amounts of persuasive information about products, much of it adhering to the item itself. Shoppers face overwhelming amounts of information, only a small part of which they treat as relevant. Even this information is brought into play only when a shopper establishes a new choice or updates an old result. In general, through time, the experienced shopper transforms an information-rich arena into an information-

specific setting. These transformations of past experience, taking place in the appropriate setting, form an integrated whole that is the basis of what appear to be habitual, mechanical-looking procedures for collecting items purchased regularly.

The integration of activity-in-setting is not limited to repeated purchases. Nor is setting merely a stage within which action occurs. The setting imposes shape on potential solution procedures even in new cases of search or problem solving. Indeed, the setting often serves as a calculating device. One shopper found an unusually high-priced package of cheese in a bin. He suspected an error. To solve the problem, he searched through the bin for a package weighing the same amount and inferred from the discrepancy between prices that one was in error. His comparison to other packages established which was the errant package. Had he not transferred the calculation to the environment, he would have had to divide weight into price, mentally, and compare the result with the price per pound printed on the label, a much more effortful and less reliable procedure. Calculation of weight/price relations devolved on the structured relations between packages of cheese (whose weight varied within only a small range; weight, price per pound, and price were printed on each package but not the steps in the calculation of price per pound) and the activity of the shopper (who searched among them for an instructive comparison). In another case, a shopper exploited the fact that chicken thighs come in packages of six. She compared package prices and chose a cheap one to ensure small size, explaining that she would select a moderate-priced package when she wanted larger serving portions. In this case also, weight/price relations were enacted in the setting.

Shoppers describe themselves as engaged in a routine chore, making habitual purchases. But their description must be addressed as data, not as part of the analysis. "Habit" and "routine" should be treated not as empirical descriptions of repeated episodes of the same activity in the same setting but as statements of an ideological order. For the arena and the general intentions of the shopper ("doing weekly chores"; "grocery shopping, again") come into juxtaposition repeatedly in such a way as to make it both customary and useful for the shopper to claim that shopping is "the same" from one occasion to the next.

The similarity is not a matter of mechanical reproduction, however. Grocery lists almost always include nonspecific categories

such as "treats" for children. The category is reproduced from week to week, but the specific treats vary, often in response to features of the setting (e.g. a candy sale, a new fruit in season). Indeed, as the fruit example indicates, the setting generates activity as well. Consider also the experience of walking past a display and having a delayed reaction, which leads to a backtrack and consideration of a needed but forgotten item. Since activity and setting, as well as relations between them are highly structured, shoppers have many alternative ways to generate a path through the store. Thus the sequence of choices of grocery items as the shopper moves through the aisles, is not all that heavily constrained. What the shopper learns from past experience is not a fixed path through the setting but numerous short-run structuring devices that can be played end to end, to produce one path this time, a different but structurally related path another time.

For instance, shoppers generally do not order their physical activity to conform to the order of their private grocery lists, which would involve much greater physical effort than ordering their activity to conform to the market layout. This is confirmed by a shopper: "Well, let's see if I've got anything over in this . . . I usually look and see if I've got anything in these, yeah, I need some potatoes. I usually shop in the department that I happen to be in. I check my list to see if I have anything on the list, to save me from running all over the store."

Saving physical effort is a useful rationale for using setting to organize the sequence of shopping activity. But a more general — and generative — principle is at work. Personal grocery lists order items differently than these same items are organized in the supermarket arena. Partial orderings of related items are often found on grocery lists, reflecting the manner in which the list was generated. It is still the case, however, that lists are fundamentally collections of discrete, independent items. Within grocery shopping the segments of activity are relatively independent, and hence one segment is rarely a sequentially ordered condition for another one. Almost by default, then, the structure in the setting — the shoppers' version of the layout of goods on the shelves and aisles — is what they utilize to order their activity. This gives the appearance of a choice between mental and physical effort, when the choice is in fact between a more or a less compellingly structured component of the whole activity-in-setting, any structure being available for

use in sequencing the activity. Thus, when shoppers' lists involve item interdependence (e.g. buy eggs only if the ham looks good), the source of sequencing might just as well be the lists instead of the market layout, or some mix of the two.

In sum, an activity-in-setting that is labeled by its practitioners as a routine chore is in fact a complex and generative task. Descriptions of the activity as "habitual" and "routine" are ideological in nature, leading shoppers to interpret their own activity as repetitive and highly similar across episodes, rather than to treat its nonmechanical, generative variability as normative. These considerations must surely affect the manner in which shoppers come to see certain parts of activity-in-setting as smoothly repetitious and other parts as problematic.

Arithmetic Activity in Grocery Shopping

Grocery shopping activity in the supermarket setting provides the context that determines which events shoppers will experience as problematic, and in what respects. These particular features of grocery shopping "problems" in turn give specific shape to arithmetic problem-solving. Arithmetic in the market is strongly marked, for instance, by shoppers' views that shopping is a routine activity. In the dialectical relation between grocery shopping and the supermarket setting, repeated interactions produce a smooth "fit" between activity and setting, streamlining each in relation to the other, and generating expectations about how the activity will proceed. A "routine" episode is expected to unfold unproblematically and effortlessly, as if ideally the whole enterprise had the status of an operation, in activity theory terms. It is in relation to this expectation that "problems" take on meaning; they are viewed as snags or interruptions in the smooth process of shopping. Further, where both expectations and practice lead to relatively unproblematic activity, snags and interruptions will be recognized, indeed generated, so as to be limited in scope — small-scale relative to the activity as a whole.

Another determinant of the character of problem solving in grocery shopping is the nature of choices to be made by the shopper. The supermarket is thought of by consumers as a locus of abundant choices, for which the stock of thousands of items constitutes apparent evidence. But contradicting this view is a different order

of circumstances: the shopper cannot provide food for the family if he leaves the supermarket empty-handed, due to attacks of indecision. That is, the shopper, faced with abundant alternatives, nonetheless cannot avoid making choices. Conversely, because the making of choices cannot be avoided, it is to the seller's advantage to proliferate decision criteria in the shopping setting. This contributes to the shopper's experience of abundant choices, helping to maintain the contradiction between choice and the necessity of choosing. This contradiction is not itself generally recognized, much less viewed as problematic, by shoppers. But in conjunction with the routine and dialectical character of shopping it contributes to the structuring of arithmetic activity.

These characteristics — the generative routine, the contradictory quality of routine choices, and the dialectical form of activity-in-setting — together shape the rationalizing character of arithmetic calculation in the supermarket. The term *rationalization* has been proposed as a hallmark of everyday decision-making (e.g. Bartlett, 1958). It is used in common parlance to refer to after-the-fact justification of an action or opinion. The term contrasts sharply with folk characterizations of rational decision-making, in which evidence should provide logical motivation for a conclusion. Without the contradiction, the production of a rational account of choices would not be construed by the observer as rationalization. Activity-in-setting is complex enough that a description of the activity as "marshaling the evidence after the fact" does not take into account contradictory, multiple relations between evidence and conclusions. For in decision processes such as those in grocery shopping, it is impossible to specify whether a rational account of choice is constructed before or after the fact. It occurs both before and after different orders of fact — before a unique item is chosen but after the determination that a choice must be made. The rationalizing relation of evidence to conclusion is not, then, a matter of "everyday thinking" or "unscientific use of evidence" but is an unavoidable characteristic of the dialectical constitution of grocery-shopping activity. The relations between evidence and conclusion are an inevitable outcome of the organization of the activity-in-setting rather than of the mode of operation of the everyday mind.

Although arithmetic problem-solving plays various roles in grocery shopping, its preponderant use is for price comparison. This

kind of calculation occurs at the end of largely qualitative decision-making processes which smoothly reduce numerous possibilities on the shelf to single items in the cart. A snag occurs when the elimination of alternatives comes to a halt before a choice has been made. Arithmetic problem-solving is both an expression of and a medium for dealing with these stalled decision processes. It is, among other things, a move outside the qualitative characteristics of a product to its characterization in terms of a standard of value, money.

That arithmetic is a prevalent medium of problem solving among shoppers is itself an interesting problem. Certainly the terms in which it is used to justify choice are symbolically powerful in this society, being mathematical, "objective," and monetary. In the supermarket, calculation may be the most immediate means of rational account construction in response to interruption because of its condensed symbolic connections to both mathematics and money, that is, its position in folk theory about the meaning of rationality. Indeed, a good case can be made that shoppers' ideological commitment to rational decision-making is evidenced by their justificatory calculations and explanations, for the alternative is to declare that choices as constrained as those for which price arithmetic is invoked are arbitrary and hence not worth effort to explain. One shopper, referring to a television commercial in which an animated package of margarine gets in an argument at the dinner table, selects this brand and comments ironically:

Shopper: I'll get the one that talks back.
Observer: Why?
Shopper: Others would have been more trouble.

Support for the interpretation of price arithmetic as rational accounting, in both senses of that term, comes from research on the decision processes used by shoppers in choosing grocery items (Murtaugh, 1984), which showed that if arithmetic is utilized, it is employed near the end of the process, when the number of choices still under consideration is not greater than three and rarely greater than two. Of 803 grocery items purchased by 24 shoppers, 312 involved explicit problem solving through consideration of alternative brands and sizes. Of these 312 cases, 125 involved some arithmetic calculation; this represented about 16% of the total items purchased. Most of these cases — 77 in all — involved price

comparisons among different brands within the same product-class. Since data were recorded on the prices and quantities of each grocery item mentioned by a shopper, it was possible to test objectively the shopper's claim that one item was less expensive than another. In only four of the 77 cases did the shopper proceed to select the more expensive alternative.

This finding indicates that shoppers are not comparing prices merely to gain information that will then be weighted appropriately with respect to other information, such as other features of competing brands. Rather, shoppers explicitly compare prices only when they have no strong preference among brands. In the light of these data, it would be difficult to picture arithmetic as a major motivation "driving" shopping activity. Justifying choices, just before and after the fact, is a more appropriate description of its typical character.

Dialectically Constituted Problem-Solving

If activity-in-setting as a whole is crucial in shaping problem solving, the character of problem-solving activity should vary from setting to setting. The supermarket data supported this view (see also Barker & Wright, 1954; Barker, 1963). We compared shoppers' arithmetic in the supermarket with their performance on an extensive paper-and-pencil arithmetic test, covering integer, decimal, and fraction arithmetic, and using addition, subtraction, multiplication, and division operations, based on a test from the Torque Project at MIT. The twenty-five shoppers varied in the amount of their schooling and in the time since their schooling was completed. Their scores averaged 59% on the arithmetic test, compared with a startling 98% — virtually error free — arithmetic in the supermarket. The subtest scores on the arithmetic test correlated highly and significantly with each other (from .72 to .84, at .001), but not with the frequency of arithmetic problem-solving in the supermarket. The frequency variable was employed after the problem-solving success variable in shopping showed no variance. Willingness to engage in arithmetic activity provides an alternative index of facility with arithmetic. Number of years of schooling correlated highly with performance on the arithmetic test ($r = .47$, $p = .003$) but not with frequency of calculation in the supermarket. Years since completion of schooling likewise correlated significantly with arithmetic test performance ($r = -.53$, $p = .001$) but not with frequency of grocery-shopping arithmetic ($r = .12$, n.s.). In short, to the extent that correlational evidence provides clues, arithmetic problem-solving in test and grocery shopping situations appears quite different, or at least bears different relations with shoppers' demographic characteristics. Analysis of the specific procedures utilized in doing arithmetic in the supermarket lends substance to this conclusion, besides illustrating the dialectical form of arithmetic problem-solving.

A successful account of problem-solving procedures in the supermarket must explain two puzzles uncovered in the grocery-shopping data. The first puzzle is the virtually error-free arithmetic performance by shoppers who made frequent errors in parallel problems in the formal testing situation. The other puzzle is the frequent occurrence of more than one attempt to calculate in the course of buying a single item. Shoppers carried out 2.5 calculations, on average, for each grocery item that served as an occasion for arithmetic. Further, while the nearly error-free character of ultimate problem-solutions is a remarkably clear finding, intermediate calculations in a sequence when more than one occurred, were often in error. This must be accounted for as well.

The routine nature of grocery-shopping activity and the location of price arithmetic at the end of decision-making processes suggest that the shopper must already assign rich content and shape to a problem solution by the time arithmetic becomes an obvious next step. Problem solving under these circumstances is an iterative process. It involves, on the one hand, what the shopper knows and what the setting holds that might help and, on the other hand, what the solution looks like. The activity of finding something problematic subsumes a good deal of knowledge about what would constitute a solution. In the course of grocery shopping many of a problem solution's parameters are marshaled into place as part of the process of deciding, up to a point, what to purchase. Consider the shopper who knew which cheese package was inconsistent with others before he established whether there was really an inconsistency or not. The dialectical process is one of "gap closing," to adapt Bartlett's (1958) term, between strongly specified solution characteristics and information and procedural possibilities for solving the problem.

Thus a change in either solution shape or resources of informa-

tion leads to a reconstitution of the other: the solution shape is generated out of the decision process up to an interruption or snag. But the act of identifying a problem changes the salience of setting characteristics. These in turn suggest, more powerfully than before, procedures for generating a specific solution. Information and procedural knowledge accessed by eye, hand, or mental transformations thereof make possible a move toward the solution or suggest a change in the solution shape that draws it closer to the information at hand.

One segment of a grocery-shopping expedition illustrates the dialectical nature of gap-closing arithmetic problem-solving processes and, more specifically, makes it possible to typify some of the parts of such processes. However, in view of the contradiction inherent in the enterprise of observing "the ordinary," caution is appropriate about the relevance of this example to the interpretation of price arithmetic as rational account-production activity. For it seems probable that interaction between the shopper and the observer in the example has given a special character to the activity segment, perhaps not a difference in kind of activity so much as in emphasis. The shopper may well think of the observer as the embodiment and arbiter of normative shopping practices; while the observer believes his own role is to investigate empirically the appropriateness of normative models of rational problem solving. The combined effect of the assumptions each has about the observer's role is to intensify the focus on rational accounting, in terms common to folk ideology and much of consumer economics, at the expense of the qualitative character of decision making which in fact leads to most purchase selections in the supermarket, even in the data.

In the shopping transcript, a forty-three-year-old woman with four children discusses the price of noodles while taking a few steps toward the noodle display:

Shopper: Let me show you something, if I can find it. I mean talk about price. Last week they had that on sale I think for 59 cents.

Observer: Spaghetti?

Shopper (with the vagueness associated with imminent arrival): Yeah, or 40—I can't remember . . . That's not the one.

The shopper then puts an old result into practice, taking a package of elbow noodles from the shelf and putting it in her cart. It is a

32-ounce package of Perfection brand noodles, costing $1.12. This decision prefigures and shapes the course of the subsequent conversation and calculations. The latter are best-buy problems, comparing price per unit of weight for pairs of packages. The other three packages weigh 24 ounces, 48 ounces, and 64 ounces. The difference in price per unit is not a linear function of size:

American Beauty noodles	24 oz. for $1.02	68¢/lb
Perfection noodles	32 oz. for $1.12	56¢/lb
American Beauty noodles	48 oz. for $1.79	59½¢/lb
American Beauty noodles	64 oz. for $1.98	49¼¢/lb

The 64-ounce package is clearly the best buy.

Observer (acknowledging the shopper's choice of the 32-ounce package): Perfection.

Shopper: Yeah, this is what I usually buy. It's less expensive than—is that American Beauty?

Observer: Yeah.

Shopper: That, what I need right now is the elbow macaroni. And I always buy it in two-pound . . . [packages]. I'm out of this.

The statement, "It's less expensive than . . . American Beauty," is the choice that establishes the point of reference for comparative calculations. The statement, "I always buy it in two-pound packages," establishes an initial solution shape. This statement also provides evidence both that the choice is an old result and that numerical simplification work has occurred, since the weight on the package is expressed as "32 ounces" rather than as "2 pounds." The shopper expands on the qualitative choice criteria that have shaped her purchases in the past:

Observer: This seems like a big package of elbow noodles, and you add these to the macaroni?

Shopper: I add some, I just take a handful and add it to the rest, to the other packaged macaroni, 'cause I add macaroni to it. Plus I use that for my goulash.

Observer: For the goulash. O.K. And you like this particular kind? Are there other alternatives here?

Shopper: Yeah. There's large elbow. This is really the too-large economy bag. I don't know if I, probably take me about six months to use this one. And I just, I don't have the storage room for that kind of stuff. I guess if I rearranged my cupboards, maybe I could,

but it's a hassle. . . . I don't know, I just never bought that huge size like that. I never checked the price though on it. But being American Beauty, it probably costs more even in that large size.

The nature of the decision-making problem is shown here in integral relation with the particulars of interaction between the shopper and the observer. For qualitative reasons (e.g. standard meals, storage capacity) the shopper has previously avoided purchase of the large size. But she is caught in a public situation in a discussion in which she would like to display her shrewdness as a shopper. And best-buy purchases are the best evidence of rational frugality in this setting, even though qualitative criteria take precedence for her, as for most shoppers, most of the time.

The next interchange starts a process of simplification of the arithmetic comparison. The shopper transforms large numbers of ounces into a small number of pounds:

Observer: That's what, that's six — *(Probably he is starting to say "64 ounces.")*

Shopper: It's four pounds, and what did I buy? Two? Oh, there is a big savings. Hmmm, I might think about that next time, figure out where I can keep it. I actually try to look for better prices. I used — I guess I used to, and I was such in the habit of it that some of the products I'm buying now are leftovers from when I was cutting costs. And I usually look. If they have something on sale, you know, a larger package of macaroni or spaghetti or something, I'll buy it.

If the preemptive character of financial evidence as a means of demonstrating utilitarian rationality requires illustration, this segment provides it. The shopper's clearly stated earlier decision to reject the large-size package on the basis of kitchen storage capacity is not sufficient, when challenged, to override the opposite choice on monetary criteria. She places a general value on price as a criterion for choice and correspondingly emphasizes that her current financial state does not require such choices. This has the effect of emphasizing the absolute nature of the value. It produces a half-commitment to future action, which does not seem likely to occur once the pressure of observer demand on the production of rational accounting is removed. She also adopts a strategy of, "If I can't be right, at least I can demonstrate my objectivity," both by

admitting she is wrong and by accepting quantitative, symbolically objective criteria as overridingly legitimate. Meanwhile she has made a calculation, correctly, that four pounds of American Beauty noodles would be cheaper than two pounds of Perfection noodles. It is not possible to infer what calculation took place, only that she arrived at a correct solution.

The next segment follows almost immediately in the transcript. The shopper sees what appears to be a comparison of packages which offers a counterexample to the conclusion that the large size is a best buy. If correct, it would soften the impression that she has violated a general principle ("bigger is cheaper") in her shopping strategy:

Shopper: But this one, you don't save a thing. Here's three pounds for a dollar 79, and there's one pound for 59.

She is comparing two packages of American Beauty spaghetti noodles. But what she believes to be a one-pound bag weighs only twelve ounces. She quickly notices the weight printed on the package and corrects herself:

Shopper: No, I'm sorry, that's 12 ounces. No, it's a savings.

These two statements involve two calculations. In some form (there are adequate alternatives) the first calculation was probably $1 \times 60 = 60$ and $3 \times 60 = 180$, and thus there is no difference between the items in price per pound. If the weight of the smaller bag is less than one pound, then the equations are no longer equivalent, and the three-pound bag is the better buy. Only a "less than" relation would be required to arrive at this conclusion.

The problem-solving procedures used by the shopper follow a pattern. She starts with a probable solution, but inspection of the evidence and comparison with the expected conclusion cause her to reject it. "No, I'm sorry," is her acknowledgment that the initial problem solution is in error. Pulled up short by the weight information from the package, she recalculates and obtains a new conclusion. This pattern is an example of gap-closing, dialectical movement between the expected shape of the solution and the information and calculation devices at hand, all in pursuit of a solution that is germane to the activity that gave it shape in the first place. The arithmetic is not simple in terms of the paper-and-pencil

conventions used to represent it: 1.79/3 = .59. It requires an active process of simplification to transform it into the form the shopper used.

Once the shopper has concluded that the large bag of noodles is a better buy than the small one, she comments:

Shopper: They had some on sale there one day, and the large package was like 69 for two pounds, and it was 59 for one pound. And it was just such a difference, I, you know, it was almost an insult to the shopper to have the two on the same shelf side by side

She concludes with another two-round calculation in gap-closing form. This episode is initiated by the observer, who addresses not the size difference but the monetary one, emphasizing its magnitude. The observer may be trying to acknowledge the shopper's amended views, for he repeats her previous conclusion:

Observer: Well, you seem to think this was a real big difference, then, this four pounds of—

Shopper: Yeah, that is. That's two dollars for four pounds *(referring to the American Beauty elbow noodles).* This is a dollar *(referring to the Perfection elbow noodles in her cart).* That's 50 cents a pound, and I just bought two pounds for a dollar 12, which is 60. So there is a difference.

The shopper begins by simplifying $1.98 to two dollars and $1.12 to one dollar. But the calculation leads to the conclusion that both are 50 cents per pound. This conclusion does not fit the established solution shape, "a big difference" between the smaller and larger bags of noodles. The current problem, as simplified, produces the intermediate solution that four pounds of noodles for two dollars is 50 cents per pound. This move serves two purposes: it is a means to recheck information simplified from that printed on the package, and it is the first item in the next round of calculation. The second round is a similar price comparison, but with a "more than" relation: $1.12 is more than one dollar. It would be consistent with a desire to appear objective and to meet the norms of the observer that the shopper would round up from 56¢/pound to 60¢. She thereby reiterates the earlier conclusion about the direction of difference in price.

One characteristic of gap-closing arithmetic procedures is the need to assign multiple functions to individual moves. Dialectically ordered problem-solving processes pose this problem. It may be necessary to give up the goal of assigning arithmetic problems to unique locations—in the head or on the shelf—or labeling one element in a problem-solving process as a "calculation procedure," another as a "checking procedure." It may be difficult even to distinguish the problem from its solution.

Research on the acquisition of arithmetic skills by new members of Weight Watchers (de la Rocha, in preparation) posed the problem of food portion control: "Suppose your allotment of cottage cheese for the meal is three-quarters of the two-thirds cup the program allows?" The problem solver in this example began the task muttering that he had had calculus in college and then, after a long pause, suddenly announced that he had "got it!" From then on he appeared certain he was correct, even before carrying out the procedure. He filled a measuring cup two-thirds full of cottage cheese, dumped it out on a cutting board, patted it into a circle, marked a cross on it, scooped away one quadrant, and served the rest. Thus, "take three-quarters of two-thirds of a cup of cottage cheese" is not just the problem statement but also the solution to the problem and the procedure for solving it. Since the environment was used as a calculating device, the solution was simply the problem statement, enacted. At no time did the Weight Watcher check his procedure against a paper and pencil algorithm, which would have produced ¾ cup × ⅔ cup = ½ cup. Instead, the coincidence of problem, procedure, and enactment is the means by which checking takes place. This implies that there is a strong monitoring potential in gap-closing procedures, when various aspects of problem solving are juxtaposed.

The calculations made by the shopper in the supermarket were possible because of her active construction of simplified versions of them. In order to do the complex work of simplifying problems, she needed a clear grasp of "what she was doing." "Knowing what one is doing" means generating a process oneself, in context (e.g. decision making in the supermarket). Then, when faced with a snag, one has already produced a partial form of the solution.

Checking procedures, in this analysis of gap-closing arithmetic, consist of an ongoing process of comparing the current state of knowledge of the problem and the current definition of the solution. The intention is to check the plausibility of both procedure and solution in relation to previously recognized constraints on

answer characteristics rather than by comparison of two linear problem-solving procedures without reference to such constraints (the convention in pencil-and-paper arithmetic-checking procedures).

In supermarket arithmetic, an alternative to arithmetic problem-solving is abandonment of the arithmetic and resolution of snags through exercise of other options. Abandonment of a calculation may occur when it becomes too complicated for solution within grocery-shopping activity in the supermarket setting. Abandonment, like a high level of success at calculation, supports the view that the juxtaposition of various aspects of problem solving makes monitoring of the process exceptionally productive. In one example, a forty-five-year-old mother of five children and her fifteen-year-old daughter are shopping, together with the observer. The mother is interested in ketchup but turns to the barbecue sauce, next to the ketchup, when her daughter calls attention to it:

Daughter: Do you want some Chris and Pits barbecue sauce? We're almost out.

Shopper (to the observer): Heinz has a special *(on ketchup)*. I have a coupon in here for that. And I was going to make spareribs one night this week, which I didn't mention to you, but that was in my mind now that she mentions the sauce. *(Examines her coupons.)* I want to see if their price on their barbecue sauce is going to be as — we usually buy Chris and Pits. *(Notices a Heinz ketchup coupon.)* Now see, this is the one that I was telling you about. But they don't have the 44-ounce ketchup here. *(Continues searching through the coupons until she finds the one for the barbecue sauce.)* Okay, 25 cents off any size flavor of Kraft Barbecue Sauce, including the new Sweet and Sour, which I would like to try because I'm going to have spareribs. But if you notice they don't have it — Oh, here they do. Hickory.

Observer: Kraft Hickory Smoked.

Shopper: Yeah, but they don't have the Sweet and Sour. *(To her daughter.)* You see it, D? Nope. Okay, see now, in a situation like this it's difficult to figure out which is the better buy. Because this is — I don't have my glasses on, how many ounces is that, D? *(Refers to Kraft Hickory Smoked.)*

Daughter: Eighteen.

Shopper: Eighteen ounces for 89, and this is? *(Refers to Chris and Pits.)*

Daughter: One pound, seven ounces —

Shopper: Twenty-three ounces for a dollar 17. *(Speaks ironically.)* That's when I whip out my calculator and see which is the better buy.

The comparison to be made is simplified by putting both weights into the same units. But it is difficult to simplify further: 18 ounces for 89 cents must be compared with 23 ounces for a dollar and 17 cents. The comment about using a calculator can be interpreted, solely on the basis of its tone, as a move to abandon the calculation. More convincing evidence of this intent is the fact that the shopper has a calculator in her purse, which she previously told the observer she uses rather frequently in the supermarket, yet on this occasion, as in the purchase of all but one grocery item, she makes no effort to get it out and suit her action to her words. She makes one more attempt to solve the problem and then abandons it even more definitively:

Observer: So what are you going to do in this case?

Shopper: In this case what have we got here? I'll try to do it quickly in my head . . . They don't have the large, um —

Daughter: Kraft Barbecue Sauce?

Shopper: Yeah, so what I'm going to do is, I'm going to wait and go to another store, when I'm at one of the other stores, because I'd like to try this.

One choice open to shoppers is to abandon a calculation, in the course of which they choose an option other than calculation as a basis for completing the decision process. Supermarket settings and grocery-shopping activity are rich in options for completing decision processes, and this circumstance adds support to what already appears to be a low penalty level for abandoning calculation in favor of some other criterion of choice. This contrasts with other activities-in-setting in which problem generation, and hence constraints on problem solution, are furnished to the problem solver in an asymmetrically structured sequence of interaction in which the problem solver has little to say about the terms. In those circumstances the only "option" other than success is failure, as in school tests and many problem-solving experiments.

The dialectical approach to problem solving explains the multiple-calculation and ultimately error-free arithmetic practiced in the supermarket setting. Multiple calculations cannot be easily ac-

counted for in the linear progression models assumed in conventional algorithm-based arithmetic procedures. But the theory of gap-closing, dialectically constituted, arithmetic procedures predicts that calculating will occur in several stages or "rounds," which the supermarket study demonstrated in practice. Multiple calculational rounds are possible because of the initial conditions by which something becomes problematic in the course of activity-in-setting. The problem solver generates problem and solution shape at the same time; each entails the other. Procedures which operate on both problem and solution shape stand in juxtaposition to one another. Errors, which are frequent in early rounds, can therefore be recognized and instruct.

The end product of supermarket calculation is so accurate for two reasons. First, dialectical processes of problem solving make powerful monitoring possible because of the juxtaposition of problem, solution, and checking activities. When properties of the setting join in as calculating devices, they add another factor to those already juxtaposed: the enactment of problem solving. Second, any circumstance that makes abandonment of a calculation a feasible alternative leads to fewer completed calculations, but more correct ones, than if options were not available. If the process of problem generation is under the control of the problem solver, the solution shape is generated at the same time; alternatively, the problem solver may exercise options other than calculation.

Arithmetic practice may change over time within grocery shopping activity-in-setting. The effortful process of snag repair leads to a choice — to the moving of an item from shelf to shopping cart and the resumption of the rhythm of routine activity. The snag has been transformed into a rationally accountable choice. That choice replaces both problem and solution effort in future grocery-shopping episodes. But such a choice creates the terms for the occurrence of new snags, either as the choice becomes a baseline for new comparisons or as the criteria invoked in a rational account are violated (e.g. by rising prices, changes in relations of price and quantity, changes in family composition or food preferences).

As a whole, grocery-shopping activity changes over time, in a changing arena, in relation to changing activities-in-other-settings, and as a result of the activity taking place across repeated episodes. Shoppers marshal ideological efficiencies partially to domesticate this variability; but if they are to shape activity effectively, there must be scope within it for investigating, checking, updating, and

reflecting changes occurring in this setting and elsewhere. To be effective over time requires smooth routines partly because this enables shopper-setting interaction focused about instructive novelties.

Snag repair contrasts with a routine choice when it becomes, for the moment, an activity-setting relation at its simplest. Think of the shopper's daughter in the last example as part of the setting. The daughter pointed out the barbecue sauce. The shopper did not go through a choice process initially. Instead, she and the setting brought a choice into being. She reflected this in her comment, "That was in my mind, now that she mentions the sauce." The relevant aspect of the setting need not be a person: replace the daughter with a bottle of sauce on the shelf, and an equivalent event would be the shopper who does a double-take as he passes this display and backtracks slightly to transfer the "forgotten" item from shelf to cart. Each may be thought of as a moment in the dialectical constitution of activity and setting.

Conclusions

The defining characteristics of arithmetic problem-solving in supermarkets must be sought in the dialectical constitution of grocery-shopping activity in the supermarket setting. Thus, in relation to the routine character assigned grocery-shopping activity, problems impinge on the consciousness of shoppers as small snags to be repaired. Given this ideology of routine and the complex structure of choice in the supermarket setting, arithmetic is used to produce rational accounts of choice. Procedures for solving problems are dialectically constituted, in the sense that setting and activity mutually create and change each other; in the process, "problems" are generated and resolved. These characteristics emerged from analysis of arena, setting, and activity. Had the template instead been the school ideology concerning linear algorithms for problem solving, analyzing the arithmetic practices would have been impossible. This demonstrates the value of analyzing both the context of activity and the activity in context.

This analytic principle has made it possible to account for price arithmetic in dialectical terms, as a process of gap closing. This process draws problems and solution shapes closer together, through operations whose juxtaposition gives them multiple functions and creates circumstances for powerful monitoring of

solution processes. Successful monitoring, in turn, provides an explanation for the extraordinarily high level of successful problem-solving observed in the supermarket. There are specific ways in which the supermarket setting stores and displays information, offers means for organizing sequences of activity, acts as a calculating device, and shapes the way in which problem solving is construed by shoppers. These characteristics are not confined to supermarkets. Most, if not all, settings store information, offer a calculating potential, and provide means of structuring sequences of activity. These are general principles of the nature of settings. Likewise, gap-closing arithmetic (the simultaneous generation of problem and solution shape and the process of bringing them into coincidence), the production of rational accounts in complex choice situations, the abandonment of calculations, and use of other options are all at work in other settings; they form a general class of arithmetic procedures, with implications extending far beyond the supermarket.

The analysis of gap-closing arithmetic, indeed the very conceptualization of practical arithmetic as a gap-closing process, has implications for theories of cognitive processing as well. *Problem solving* is unfortunately a term often used synonymously with *cognition*, to describe, but not to contextualize, such activities as arithmetic practices. The assignment of unwarranted theoretical centrality to problem solving reflects a failure to comprehend these activities as practices *sui generis*. This conventional theoretical framework views a problem as "given," the generic "independent variable" in the situation. The effort, the solving of the problem, is correspondingly characterized as disembodied mental activity. But the reduction of cognition to problem solving *per se* simply cannot grasp the generative nature of arithmetic practice as cognitive activity. In dialectical terms, people and settings together create problems and solution shapes, and moreover, they do so simultaneously. Very often a process of solution occurs in the setting, with the enactment of the problem, and may transform the problem for the solver. Indeed, activity-setting relations are integral, generative, and finally dialectical in nature. This lesson applies to grocery shopping and to experience-generating segments thereof; it may be usefully applied to other, more inclusive systems of activity as well.

4. Adult Guidance of Cognitive Development

Barbara Rogoff
William Gardner

The search for influences on cognitive development has for some time focused on social interaction as an arena in which individuals encounter intellectual challenges and are guided by family and peers in learning to master them. A study of mothers assisting their children in preparing for a memory test on the categorization of objects illustrates adult guidance of children's cognitive activities. In this study instruction is conceived of as a joint problem-solving event in which a more expert individual (the mother) and a novice (the child) structure their interaction so as to transmit information from the expert to the novice. The cognitive activity that occurs in the interaction is apparent in the adaptations made by the participants as the novice gains greater understanding of the problem and as the expert evaluates the novice's readiness to take greater responsibility for the cognitive work.

Generalizing Skills and Information across Contexts

The importance of considering the context in which cognitive development occurs has been supported by research demonstrating a lack of generality of stages or capacities across situations (Brainerd, 1978; DeLoache & Brown, 1979; Feldman, 1980; Siegler, 1981; Rogoff, 1982a). Nevertheless, people are clearly able to generalize some aspects of existing knowledge and skills to new situations. Knowledge and skills have more general applicability than the specific episode in which they were originally learned or applied. Yet little is known about how people transfer skills from one problem to another or how they form a schema which includes several related but nonidentical problems.