aspects of the problem at hand (Margolis, 1987). Novices, on the other hand, do not possess sufficiently elaborated mental models of the subject matter to permit such inferences. They are consequently forced to apply more general problem-solving strategies (such as, "Break the problem into its component parts") that lack both efficiency and power in solving specific problems.

The impact of schemata on problem solving can be quite dramatic. In a series of investigations on a logical problem known as the "four-card selection task," researchers repeatedly demonstrated that few people could solve the problem when it was presented in an abstract fashion. For instance, only 4 percent of subjects correctly determined which cards to turn over when presented with the rule, "If a label has a vowel on one side, then it has an odd number on the other" (Wason, 1968). However, when the same logical problem was put into a familiar context (e.g., "Every time I go to Manchester, I travel by train"), more than 60 percent of the subjects selected the correct cards (Wason & Shapiro, 1971).

D'Andrade (cited in Rumelhart, 1980; Rumelhart & Norman, 1981; D'Andrade, 1995) suggested that the familiar context enabled subjects to access an appropriate mental model for solving the problem. He told participants they were to imagine themselves as quality control experts in a label-making factory, and their task was to determine whether labels were incorrectly constructed. A label was correctly constructed if, when there was a vowel on one side of the label, there was an odd number on the other side. Only 13 percent of the subjects were able to appropriately apply this rule. But then D'Andrade had subjects imagine themselves as store managers inspecting store receipts with the rule, if any purchase exceeds $30, the signature of the store manager must be on the back of the receipt.

Most people have probably experienced situations such as that described in the store scenario, so that they would have developed schemata related to the checking of receipts by store managers. Checking labels at a factory, on the other hand, is probably unfamiliar to most people, which means they would have to rely upon general problem-solving logic to come up with the correct solution.

Schema Acquisition and Modification

What about learning, then? How does experience contribute to the permanent modification of schemata? Three different processes have been proposed to account for changes in existing schemata and the acquisition of new schemata due to learning. They are accretion, tuning, and restructuring (Rumelhart & Norman, 1978; Rumelhart, 1980; Vosniadou & Brewer, 1987). **Accretion** is roughly equivalent to fact learning in that *information is remembered that was instantiated within a schema as a result of text comprehension* or understanding of some event. For example, remembering from the description of mayonnaise making that a blender was used to beat the eggs is indicative