Correlates of Syllogistic Reasoning Skills in Middle Childhood and Early Adolescence

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Sixth, eighth, tenth, and twelfth graders, and college students, were given a preliminary test of categorical syllogistic reasoning ability. In a subsequent session, subjects were given other categorical syllogisms and asked to depict as many of the possible relationships between the A, B, and C terms of the syllogism as they could. The number of possible relationships, and the time it took to decide if other relationships were possible, did not differ among the noncollege groups. The results indicated, however, that the correlates of reasoning proficiency differed for those subjects younger and those older than about age 13.

INTRODUCTION

Reasoning with categorical syllogisms is regarded as a skill central to thinking and intelligence (e.g., Guilford, 1959; Thurstone, 1938). It is one of the most frequently investigated, at least with adult subjects (e.g., Erickson, 1978; Galotti et al., 1986; Guyote and Sternberg, 1981; Johnson-Laird, 1982,

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Typically, subjects are presented with two premises of the form "Some A are B, All B are C." They are then asked to supply a conclusion relating the A and the C terms that is always true, given the premises, or to decide whether a particular conclusion (for example, "Some A are C") is always true. Even when the task and the meaning of logical operators and quantifiers are carefully explained, subjects often make errors on this task (Begg and Denny, 1969; Begg and Harris, 1982; Ceraso and Provitera, 1971; Chapman and Chapman, 1959; Dickstein, 1975, 1976).

Several models have been proposed to account for these findings. Galotti et al. (1986) suggested that these models can be divided into two classes, and found evidence that both types of models are needed to explain individual differences among college students. Models of the "deduction rules" class explain reasoning with syllogisms in terms of an explicit or implicit reliance on deduction rules (cf. Braine and Rumain, 1983; Osherson, 1975; Rips, 1983). For example, when given the premises "Some A are B, Some B are C," a subject might use the "two somes" rule: if both premises contain the quantifier "some," then there is no logically valid conclusion. Errors in reasoning arise if a subject lacks knowledge of a relevant rule or set of rules, or possesses the relevant knowledge but for some reason fails to apply it.

On the other hand, models of the "mental models" class (e.g., Johnson-Laird, 1982, 1983) attribute poor syllogistic reasoning to the failure to consider the different relationships that may hold between the set of A things, the set of B things, and the set of C things mentioned in the premises. In brief, these models propose that a reasoner who considers fewer of the possible interpretations and combinations of the premises will perform less well than a reasoner who considers more.

For ease of reference, we refer to a possible combination of the A, B, and C terms of a categorical syllogism as an instance. An instance, therefore, is one possibility allowed by two premises. The different "mental models" accounts of syllogistic reasoning performance propose different ways of representing premises and instances. One influential proposal was that of Erickson (1978), who assumed that the representation is isomorphic to Euler diagrams. Figure 1 presents an example of this form of representation. It shows Euler diagram depictions of possible interpretations of single premises in the top panel, and possible instances in the bottom panel.

A "mental models" description links syllogistic reasoning to other thinking and reasoning tasks in adults, such as tests of creativity or hypothesis construction, in which the generation and evaluation of possibilities or instances have been seen as fundamental processes (Perkins, 1981; Wason, 1960, 1977). It also links syllogistic reasoning to theories of cognitive development. The systematic consideration of possibilities is often identified as a major